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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. JULY 27, 1899. CHICAGO, ILL. NUMBER 30

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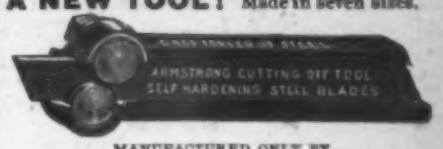

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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. JULY 27, 1899. CHICAGO, ILL. NUMBER 30

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Less buying, but no change in general conditions except it be toward greater firmness in prices and a greater emphasis upon the scarcity of material for early shipment, is the story of the iron market for the past week. The statistics of pig iron production for the first half of the year have been made public. They show a total of 6,289,167 tons, or 385,000 tons more than in the second half of 1898—not so great an increase as might have been expected under the unusual conditions that have marked the past six months. The figures accent better than the market comments of the past few months have been able to do, the hindrances to the enlargement of production, even with furnacemen straining every nerve to fit up old plants and get fuel and ore supplies sufficient to bring them into the producing column. It is a significant fact that Alabama, with all the pressure upon her furnaces to deliver iron at home and to ship it abroad, actually produced 3,800 tons less in the first half of this year than in the second half of 1898 and only 6,000 tons more than in the first half of 1898. It is very plain that Southern furnace are oversold for 1898 delivery and that the additional capacity to be blown in in that section in the next three monhs will not be sufficient to make good the deficiency. Rolling stock is already scarce and with the cotton movement soon to be added there is reason to fear that some foundries dependent upon Southern iron will not have the smoothest operation in the balance of the year. Pig iron prices, though the volume of new business has not been large in the week, are firmer. On No. 1 irons the leading Southern producer advanced the price to $16 Birmingham early in the week. Northern furnacemen are finding that they must reckon with a greater or less shortage of Lake Superior ores. The statistics of production at Lake Superior mines in the first half of the year indicate a shortage of not less than 500,000 tons of old range Bessemer ores and the Mesabi range, unless it increases its rate of shipments, which is entirely improbable, will scarcely exceed last year's record by more than 200,000 tons. The generally prevalent notion that the Mesabi can help out to any needed extent, and that the question is only one of increasing the Mesabi percentage in furnace mixtures, has evidently been leaned upon too heavily. An important deal closed this week is that by which the National Steel Co. acquires the Winthrop and Chapin mines and two fleets aggregating nine steel vessels. Its consummation adds to the already very strong position of the National Steel Co. in the steel trade of the country and of the world, as ore supply is bound to be one of the most important factors in the regime of concentrated operation. The past week has emphasized the restlessness of labor in several quarters. Dock strikes have interfered with ore unloading at Lake Erie ports, and in Youngstown mills demands of non Amalgamated men for an advance on top of that given them on July 1 has interrupted work. From all the mills come reports of overdue material for which buyers are clamoring, and of inability in several lines to take further orders for delivery in 1898. The feature of the markets for minor metals has been the further advance in pig tin, which has reached 31½c at New York, as against 13¾c at the beginning of 1898.

PITTSBURG.

OFFICE OF *The Iron Trade Review and Industrial World.*
705 PUBLICATION BUILDING, July 25

The most decided difference of opinion exists as to the probable course of the iron market this fall and during the year 1900 Opinions are not wanting that the present scale of prices will be left far in the rear by October and that while there may be some lull early next year the general average of prices will be fully up to the present level, if not higher. Others express confidence that there will be a reaction by the time any large tonnage of new business is taken, and while admitting the certainty of comparatively high prices during 1900 these prophets express the belief that the average next year wil be considerably below the present level. There is no conflict of reasoning in the two sets of opinions, but a lack of positive information regarding certain conditions which must govern the trend of prices, and the lacking information is largely of such a nature that it is not likely to be readily secured. It is claimed that at present prices there is a fair market abroad for much of our cruder forms of production. This is certainly not the case, and it cannot be learned positively whether orders which it is reported are taken for export at present market prices are really declined, or are taken at secret concessions from these prices. In finished lines it is difficult to summarize the present condition of our export trade and determine how well the tonnage exit is likely to continue. The effect of high prices for iron and steel on domestic consumption is very difficult to forecast, the more so that most iron and steel is ultimately not consumed by itself, but in connection with other materials, and with labor. The cost of these other items frequently has more to do with determining whether or no the investment will be made than has the price of the iron or steel itself. The producing and finishing plants which are being started in operation in various parts of the country, too frequently by men with practically no experience in the particular line, will be found to constitute a disturbing element. It would be a hard matter to fix for any of these plants a line below which market prices would represent a loss, and unfortunately it would not follow that these plants would be thrown out of operation even by a market declining far below such a line.

There has been little change since last week in the general range of prices. There has been a moderate tonnage movement in pig iron and steel, and in finished lines there has been the usual run of business. The inquiry has kept up well considering the time of the year, and indications naturally point to a heavier demand in a few weeks, which can scarcely operate except to raise prices.

The manufacturers of coil chain, who have a gentlemen's agreement in regard to prices, last week advanced prices all around a quarter of a cent a pound.

PIG IRON.—Something like 10,000 tons of Bessemer have been sold in the past week, most of it at $20, valley furnace, although it is understood that in some cases as high as $20.25 has been paid. The interruption to production at Sharpsville on account of the labor difficulty of the first two weeks of the month will be just about double what was expected. Six furnaces were idle close to two weeks, but when a resumption of

work was attempted it was found that three of the furnaces had cooled, and are being shoveled out. Ordinarily a furnace can be banked for from three to four weeks, but the work in this case was done so hurriedly that the best results were not secured. At these three furnaces a delay of fully four weeks is necessitated. The pressure has not become as great, however, as might have been expected, and steel mills are getting along fairly well. In gray forge there has been a moderate turnover, at about the same range of prices as quoted formerly. In foundry irons the market has been a trifle more active, and prices are quite irregular. We hear of sales at prices considerably above the average, such as $20.50 for No. 2, and $19.50 for No. 3. The whole foundry iron market is stronger than at this writing last week. We quote prices as follows:

Bessemer, valley furnace	$20.00 to $20.25
Bessemer, Pittsburg	20 75 to 21.00
No. 1 Foundry	19.75 to 20.50
No. 2 Foundry	19.25 to 20.00
No. 3 Foundry	18.75 to 19.25
Gray Forge, valley furnace	17.15 to 17.40
Gray Forge, Pittsburg	17.40 to 17.65

STEEL.—The steel market is rather quiet. Deliveries are about as much behind as they were. Slabs command considerable higher prices relatively than billets, the quotation on which is largely nominal, as there is practically no inquiry. We quote 4x4 billets, at $33.50 to $34, with slabs from $34 to $35, and scarce at that.

FERRO-MANGANESE.—There is no change in this line, the demand continuing very good. The local producer continues to quote $85 for large lots.

RAILS AND TRACK MATERIAL.—There is nothing doing in rails, and prices quoted range from $28 to $32. In track material the demand continues good, at unchanged prices as follows: Spikes, 2 25c to 2.30c; track bolts, 2.65c to 2.75c; splice bars, 1.75c to 1.90c; links and pins, 2.15c to 2.25c.

BARS.—The market for both steel and iron bars is good, and prices are well maintained. We quote bars made from all muck iron, and steel bars both at from 2.05c to 2.15c.

STRUCTURAL MATERIAL.—There is no change to be noted in structural this week. There is the usual demand for small operations, and prices remain at prices formerly established. We quote as follows: Beams and channels, 3 to 15 inches, 2c; 18 to 24 inches, 2.10c; tees, 2.05c; zees, 2.05c; angles, 2c. Universal mill plates have advanced to 2.40c to 2.50c.

PLATES.—The mills have practically no plates to sell for delivery within three months, and are fairly well sold for the balance of the year. For nearby deliveries small odd lots are being sold at fancy prices. For later, delivery we quote the market $2 a ton higher as follows: Tank, 2.50c; shell, 2.60c; flange, 2 75c; fire box, 3½ to 4c.

PIPES AND TUBES.—There is no change in the market. The National Tube Co. has formal possession of the mills, but the administration of affairs remains in former hands. There is no cause for haste in completely organizing the selling end of the business because there is very little to sell, and the individual makers had been working in close harmony for a long time. We repeat former quotations as follows: Merchant pipe, base discount, 50 per cent and additional discounts two 10's for less than carloads and two 10's and 5 for carloads, with free delivery on the latter within the prescribed territory; lap weld casting, 40 for screw and socket joint and 35 for inserted joint, with 5 per cent additional on carload orders; boiler tubes, 1¼ to 1½ inch, 40 per cent; 1¼ to 2½-inch, 50 for iron and 55 for steel; 2¾ to 6-inch, 55 for iron and 57½ for steel; extra 5 per cent to dealers.

SHEETS.—The sheet market is firmer, and quotations range from 3.10c to 3.25c for No. 28 common, many of the mills being practically out of the market for nearby deliveries. Galvanized is stronger, and nothing below 70 and 5 can be done, with a 15-cent freight allowance.

SPELTER.—Spelter is weaker and is down to 5.75c, New York, for prompt shipment, with about the same price in Pittsburg. The St. Louis market is dull at 5.65c.

PIG TIN.—The highest prices for many years have been paid for pig tin this week, the market having advanced until 31½c has been paid at New York. The lowest price was about 12½c, in the fall of 1896. At the beginning of last year pig tin was 13¾c.

OLD MATERIAL.—Scrap is rather scarce, and prices are quite irregular, in most lines a considerable range existing. We quote prices unchanged, about as follows: New melting stock, $17; old steel rails mixed lengths, $16.50 to $17; cut, $17; old iron rails, $21 to $22; wrought iron scrap, $17 to $18; cast borings, $9 to $9.50, net, Pittsburg, busheling scrap, $12.50 to $13 net; car wheels, $17.50, gross; cast scrap, $16.50 to $17, gross; wrought turnings, $11, net, Pittsburg.

COKE.—The coke market is unchanged from last report. We quote strictly Connellsville furnace coke at $2.25 and crushed and foundry at $2.15 to dealers and $2.30 to consumers.

CHICAGO.

Office of The Iron Trade Review and Industrial World,
1522 MONADNOCK BLOCK, July 25.

For the first time this summer the tone of the market shows some semblance to the dull condition that are natural at this season of the year. There has been comparatively little new buying but the similarity to the usual mid-summer aspect ends with that inactivity. The environment of the market has not changed, so far as can be seen, from what has been noted for many weeks. Though buying is not large, inquiries are greater than can be favorably considered by the makers and sellers of iron product. A considerable tonnage of all sorts could be placed were deliveries possible during the next two or three months, or even later in the year. Prospective buyers are discouraged by the persistent refusal of the makers to even quote prices. Thus, this week, an inquiry for rails for a 54-mile stretch of track in Indiana went begging. None of the mills could fill the order for this season's delivery. And much the same state of affairs is found generally.

PIG IRON.—The gap between high and low prices seems to be widening. There are in fact almost all kinds of prices, from the minimum that was quoted last week, to 25 cents or more above the maximum of a week ago. The largest Southern producer has advanced prices 25 cents. Some Southern furnaces are disposed to sell their output for next season's delivery at a slight concession from the prices that are asked for immediate delivery. For spot shipment there is brisk demand and scant supply. Some sellers of Southern iron on the other hand are disinclined to quote any prices for delivery after Jan. 1. The inquiry for these remote shipments comes largely from the malleable trade, though not exclusively. While some good sized lots have thus been covered, contracts for distant deliveries are discouraged by sellers. The new furnaces that have lately been put into blast are not working quite up to expectations, as a rule, though turning out a fair amount of iron. Quotations are as follows:

Lake Sup. Charcoal	$21 00 @ $23 00	Southern Coke No. 3	$18 15 @ $19 15
Local Coke Fdy. No. 1	19 50 @ 20 00	Southern No. 1 Soft	19 65 @ 20 40
Local Coke Fdy. No. 2	19 00 @ 19 50	Southern No. 2 Soft	18 65 @ 19 65
Local Coke Fdy. No. 3	18 50 @ 19 00	Southern Silveries	21 00 @ 22 00
Local Scotch Fdy. No. 1	19 50 @ 20 00	Jackson Co. Silveries	23 00 @ 25 00
Local Scotch Fdy. No. 2	19 00 @ 19 50	Ohio Strong Softeners	21 00 @ 22 00
Local Scotch Fdy. No. 3	18 50 @ 19 00	Alabama Car Wheel	19 50 @ 20 00
Southern Coke No. 1	19 65 @ 20 40	Malleable Bessemer	20 00 @ 21 00
Southern Coke No. 2	18 65 @ 19 65	Coke Bessemer	20 00 @ 21 00

BARS.—Trading in bars, both iron and steel, seems to be of a steadier character than in most products. Prices also are fairly even. There is no quotable change from a week ago. Sales during the week have just about represented the production. Car trade is in evidence and some transactions for lots of several thousand tons have been closed. Iron bars are quoted at 1.85c to 1.95c and steel from 2c to 2.10c.

STRUCTURAL MATERIAL.—Little is to be said this week. Sales have been small and prices firm. But inquiry for early delivery has been notably in excess of the ability of mills to produce. Quotations follow: Beams, 15 inches and under, 2.15c to 2.20c; 18 inches and over, 2.25c to 2.35c; angles under three inches and over six inches, 2.25c to 2.35c; three inches to six inches, 2.15c to 2.25c; sheared plates, 2.85c to 3c; universal plate, 2.75c; tees, 2.20c to 2.30c; zees, 2.20c to 2.30c; small lots from store are quoted from ¼c to ½c higher.

PLATES.—Pressure is just a little greater. One sale of about 2,000 tons of tank for next year's delivery was made at 2.50c. For early shipment that price can not be approached. Small consumers are suffering from lack of sufficient material and the tone of values is very strong. Tank steel from store is quoted 3c to 3.30c. Mill shipments, Chicago delivery, are as follows: Tank steel, 2.80c; shell, 2.90c; flange, 3c; marine, 3c; fire box, 3c to 5c, according to brand.

MERCHANT PIPE.—It is understood that the National Tube Co. will take possession of stocks of its constituent mills at

Chicago about Aug. 1. In the meantime the market continues very strong. Steel pipe is now quoted 50 and 10 per cent.

SHEETS.—The advance in the price of black sheets seems to be general this week. Galvanized is in active demand, some interests here reporting the best business they have ever experienced. From mill, quotation is 70 and 5 per cent; store quotation remaining at 70 per cent. No. 27 black sheets are 3.15c to 3.25c.

MERCHANT STEEL.—The agricultural trade continues to buy steadily and is expected to be in the market for some weeks. The market is very firm. Smooth finish tire steel is quoted 2.45c to 2.50c; smooth finish machinery steel, 2.70c to 2.75c; spring steel, 3.20c to 3.30c; tool steel, 6c to 7.50c; special, 10c and upwards.

BILLETS AND RODS.—Some large transactions in rods for future deliveries are not unlikely in the near future but present trade is limited. Billets are quiet and very strong. Quotations are largely nominal. Bessemer billets are quoted $33 to $35; sheet bars $2 higher. Rods are nominally $42 to $45.

RAILS AND TRACK SUPPLIES.—There is a moderate demand for both light and standard sections. Sales of the former are about equal to production and can yet be arranged for late fall delivery, but the appearance of a good sized inquiry for standard sections immediately develops an oversold state for the current season. Standard rails are quoted $31 to $32; light rails, $31 to $37. Splice bars are 1.70c to 1.85c; spikes, 2.40c to 2.50c; track bolts, 2.90c to 3.25c.

OLD MATERIAL.—There is no new feature this week. Prices are steady and trading of a moderate volume. We quote as follows:

Old iron rails, gross,	$18 50@$19 00	Axles, net	$19 00@$20 00
Old steel rails, long, gr.	15 00@ 15 50	Cast borings, net	6 50@ 7 00
Old steel rails, mixed	14 50@ 15 00	Wrought turnings, net	7 50@ 8 00
Old wheels, gross	15 50@ 16 00	Axle turnings, net	8 25@ 8 75
Railroad forge, net	15 50@ 16 50	Mixed steel, gross	10 50@11 00
Dealer's forge, net	12 00@ 12 50	Stove plates, net	7 50@ 8 00
No. 1 mill, net	9 00@ 9 25	Heavy melting steel, gr	13 00@14 00
Heavy cast, net	12 00@ 12 50	Old iron splice b., net.	17 00@18 00
Malleable cast, net	8 50@ 9 00		

WIRE AND WIRE NAILS.—There is considerable activity in nails, the recent advance not checking trade to any considerable extent. Consumption is very large. Wire is less active, and prices without further change. Makers quote single car loads of wire nails on a Pittsburg basis equivalent to $2.80 f. o. b. Chicago, and $2.90 less than car lots. On wire current Chicago quotations are as follows: Plain annealed wire, $2.65; painted barb wire, $2.90; galvanized barb wire, $3.40.

CLEVELAND.

OFFICE OF *The Iron Trade Review and Industrial World.*
27 VINCENT ST., July 26.

Iron ore shipping operations have been interrupted the past week by troubles at Lake Erie docks. A recent strike at Conneaut was settled. It has been followed by one at the P. Y. & A. docks at Ashtabula. At Erie, the E. & P. dock is idle. The men at the Cleveland Rolling Mill Co. dock at Cleveland struck on Tuesday. There is a restlessness among dock laborers that increases some other uncertainties of the ore situation, one trouble being scarcely settled before another breaks out, often in the same spot. The reports of ore shipments from upper lake ports and of ore production at the mines confirm the general statements heretofore made as to a shrinking off from original estimates. Gogebic range mines in particular are developing shortages, and there are some indications that the Mesabi range will not do what has been expected of it. At the rate of shipment thus far made on the Mesabi its total would reach about 4,800,000 tons, which is only 200,000 tons more than last season's record of the range. There is reason to believe from figures thus far made that old range Bessemers, of which close to 6,000,000 tons was sold, will fall at least 500,000 tons below that amount because the ore cannot be produced. Vessel rates are 75 cents Escanaba, 85 cents Marquette, and 90 cents Duluth. On two or three cargoes $1 was paid early in the week from the head of the lake, but 90 cents was the best vessels could get on Tuesday.

PIG IRON.—Of the six Sharpsville furnaces idle in the early part of the month because of the strike, three required to be shoveled out, two required repairs, and one is still out, so that the output of that group for the entire month will be seriously affected. Very little has been done in Bessemer pig iron. The inability of steel works to get iron due them continues to be a feature of the situation. We note a sale of 1,000 tons and one of 3,000 tons at $20, valley furnace. Foundry grades are unchanged from last week, except that some sellers of Southern have put No. 1 foundry and No. 1 soft at $16, Birmingham, an advance of 25 cents, and equivalent to $20.20, Cleveland. This is still below Northern irons. There are known wants of Northern Ohio foundries yet uncovered for the last quarter of the year and the indications are that some trouble may be experienced in getting the iron. We quote the Cleveland market as below:

Bessemer	$20 75	Valley Scotch No. 1	$19 75@20 75
No. 1 Strong Foundry	19 75@ 20 75	Valley Scotch No. 2	19 00@20 00
No. 2 Strong Foundry	19 00@ 20 00	Gray Forge, valley	17 25@17 50
No. 3 Foundry	17 75@ 18 75	Lake Superior Charcoal	21 00@22 00

FINISHED MATERIAL.—The run of small lot, early-shipment orders is somewhat less than in the early part of the month. Stocks in jobbers' hands are more and more the dependence of boiler works, machine shops, and the large number of minor metal working concerns. On bars, structural material and plates, leading producers are filled up to the end of the year; and buyers are finding out every week the impossibility of working in small tonnages at the end of a rolling on contracts, every pound of material being required to apply on belated deliveries. Special pleading seems of no avail to alter mill schedules. Some sellers have advanced butt weld wrought pipe 5 per cent, making the discount 50 and two 10's on mill shipments in carload lots. Little is to be had at any price for any early delivery. Black sheets No. 27 gauge are quoted 3c mill in carload lots and 3.30c, out of stock, Cleveland. Galvanized sheets have not yet reached the height of mid-summer demand. Discounts are 70 and 5, Pittsburg mill, with 15-cent freight allowance. Cleveland sales have been made at 70 off. On heavier black sheets practically one price is asked for gauges 14 to 21, the recent changes in mill ownership diverting some tonnage into exclusive lines, leaving less for the general trade. We quote bar iron at 1.75c, valley mill, with $1 ton additional for cutting to lengths. Out of store, Cleveland, sales are made at 2c. Steel bars are stronger at 2.15c to 2.25c, Pittsburg, with mills sold six months ahead. Tank plates, ¼-inch and heavier, are 2.50c to 2.70c, Cleveland, and practically unobtainable. The structural mills are unable to entertain new business.

WIRE AND WIRE NAILS.—The advance last week of 15 cents a keg in the price of wire nails to jobbers in large lots has been attended by some irregularity in jobbers' prices. Some quote on a Pittsburg basis of $2.65, and others the equivalent of $2.70, Pittsburg, on single carload lots. The Pittsburg basis to retailers on less than carload lots is $2.75. The present quotation on smooth wire is $2.35, Pittsburg, in carload lots to jobbers; to retailers in carload lots $2.50, Pittsburg. We quote painted barb wire in carload lots to jobbers at $2.60, Pittsburg, and galvanized, $3.10. The demand for nails and wire is only fair. Export business continues large.

OLD MATERIAL.—The Lake Shore Railroad disposed of about 2,000 tons of material in its local sales last week, the mills being active bidders against dealers, and a considerable tonnage going direct to large interests. We continue quotations at $21, valley, for old iron rails, $15, Cleveland, for old steel rails, and $16.50 to $17, Cleveland, for old car wheels, gross tons. No 1 railroad wrought scrap is quoted $16.50 to $17, valley; busheling scrap, $12 to $12.50, valley; machinery cast scrap, $13 to $14; wrought turnings, $10.25 to $10.75; cast borings, $10; stove plate, $9 to $10, Cleveland, all net tons.

CINCINNATI.

July 25.

The week that has just passed has added strength to the situation. As far as the South is concerned it has been marked by further heavy sales of foundry and basic irons for delivery through the first six months of next year at current prices. Representatives of Southern iron masters report that the latter are not shading their prices one cent for delivery into next year, but are getting the full quotations today for sales on which deliveries will not be completed until 12 months from date and on which no shipments are to start until January 1. Advices are that the majority of furnaces in the South have badly overestimated their capacity and consequently have contracted to deliver more this year than they can make. Hence it seems certain that a considerable pro-

portion of the iron which consumers are counting on getting this year will have to be carried over into next year. There have been inquiries from abroad of an extensive kind and No. 2. foundry for foreign shipment was sold at $14.50 last week, while $15 is asked now. These prices could be easily obtained for export provided the iron was on hand to ship. There have been inquiries for coke for shipment to England. It would appear as though consumers on the other side of the water were as badly off for iron for immediate delivery as here in America. There is great complaint on the part of the iron masters throughout the South and in Ohio of a scarcity of cars. Some of the Northern furnaces have been put to the greatest inconvenience because the railroads are not able to deliver their coke and ore on time. In the South there is not enough rolling stock to meet the present demands, and what is going to happen when cotton begins to move in 60 to 90 days hence is very plain to see. In former years cotton has always been given precedence, and if history repeats itself this year consumers who are counting on prompt pig iron shipments at that time will be disappointed. It would seem, under these circumstances, that the railroads are bound to be heavy buyers very shortly. They are now trying to do a vastly increased business with an equipment that even in the dull times was inadequate and that now is shamefully short. The figures we give below represent the prices of the week. We quote for cash f. o. b. Cincinnati: Southern coke, No. 1 foundry, $18.75 to $19; No. 2, $17.75 to $18; No. 3, $17.25 to $17.50; No. 4 and gray forge, $16.50 to $16.75; mottled, $16.50 to $16.75; No. 1 soft, $18.75 to $19; No. 2, $17.75 to $18; Lake Superior coke, No. 1, $20 to $20.25; No. 2, $19.50 to $20.00; Hanging Rock charcoal, No. 1, $21 to $22; Jackson Co. silvery, No. 1, $25 to $26; Standard Georgia car wheel, $19.25 to $20.25; Lake Superior charcoal, $21.50 to $22.50.

Important Pennsylvania Consolidation.

Announcement is made from Reading, Pa., of the consummation of plans for the consolidation of four important concerns: The bolt and nut works of J. H. Sternbergh & Son, at Reading; the Lebanon Iron Co., comprising the rolling mill plant in Lebanon and the National Bolt, Nut & Rivet Works, of Reading; the Pennsylvania Bolt & Nut Works, of Lebanon, and the East Lebanon Iron Co., of Lebanon. They will unite under the name and style of the American Iron & Steel Mfg. Co. It is expected that the constituent companies will be taken over about Sept. 1. There will be 10 directors, nine of whom have already been agreed upon as follows: From the Pennsylvania Bolt & Nut Co., Arthur Brock, Horace Brock, James Lord; National Bolt, Nut & Rivet Works, including Lebanon Iron Co., C. W. Wilhelm, and H. J. Hayden, both of Reading; East Lebanon Iron Co., Harry H. Light; J. H. Sternbergh & Son, J. H. Sternbergh, Robert Sternbergh, and H. M. Muhlenberg Richards, all of Reading. The one director to be chosen will be from Lebanon and named by the Pennsylvania Bolt & Nut Co. The capitalization of the new company is not yet given out. The Sternbergh plant was established in 1865 and now gives employment to over 1,200 men in the manufacture of bolts, nuts, rivets merchant bar iron, etc. The Pennsylvania Bolt & Nut Co.'s plant was organized in 1881 for the manufacture of the same line of goods and now employs about 500 men. The Lebanon Iron Co. and the East Lebanon Iron Co. were organized for the manufacture of Merchant bar iron, and now employ about 300 men each. These several establishments have heretofore been in active competition with each other, but now find it to their mutual advantage to consolidate their business interests for the purpose of effecting numerous economies and more perfectly developing their machinery and methods of manufacture and for more satisfactorily meeting the demands of the domestic trade and increasing the growing trade in foreign countries.

At Youngstown, O., certain employes of the Valley, Brown-Bonnell and Haselton mills of the Republic Iron & Steel Co. went on a strike on Monday for an advance of 12½ per cent in addition to one of that amount that went into effect July 1. The men are outside the Amalgamated Associtiona. At the Valley mill the demand was granted and work was resumed. At the Brown-Bonnell mill the management had difficulty in adjusting the strike, the men not being organized and making no official statement of their demands.

LAKE SUPERIOR IRON MINES.

The recent attention given to Republic Iron Co. stock by Chicago brokers and the sales that have resulted, one of 50 shares at 25 being reported, has led to the issuance of a circular by the directors, which says: "There has for some time been agitation, by outside parties, of the question of purchasing at least a controlling interest in the capital stock of this company, which has recently taken the form of an application to the directors and of inquiries as to what the present owners of the stock are willing to do, to an extent which, in the opinion of the board of directors, justifies submission of the whole question to the stockholders." The proposition that follows is that a committee, composed of President W. D. Rees and Directors G. W. R. Matteson, of Providence, and W. F. Dummer, of Chicago, will receive until Aug. 21, at noon, at 25 Wade Building, stock from stockholders desiring to sell, accompanied by a power of attorney. If a majority of all shares are so deposited, the committee is to negotiate for a sale at such price and terms as possible, and at not less than $30 per share. The power of attorney will expire Oct. 20 unless the sale is made prior to that date.

Work at the Elba mine on the Mesabi range has been suspended for 30 days on account of water. New pumps are being secured.

The Oliver Iron Mining Co. is reported to have secured control of the McDonald forty on section 30, Vermillion range, from John G. Brown and others.

It is reported that the Eastern Minnesota Railway Co. will build another dock on Allouez bay, 350 feet east of the old Winnipeg ore dock, now the property of the Eastern Minnesota.

An important ore find has been made by Pickands, Mather & Co. on the land of John Greininger, on the Menominee range. The property is located about two miles south of Stambaugh, Mich., and adjoins the Dober mine. The ore was located with a diamond drill, the hole piercing over 200 feet of ore formation, principally jasper and paint rock. Sixty feet of the distance was clean ore that assayed 60 per cent in metallic iron. The hole was drilled across the formation at an angle of 60 degrees and the ore was cut at a depth of over 100 feet. Another hole is being drilled 200 feet south of the first and similar results are being met with.

Youngs & Fetzer, Sturgeon Bay, Wis., lumbermen, have made an important iron ore discovery on the Hiawatha property, Menominee range. They have 21 pits bottomed in fine ore, showing a formation of 300 feet wide and 600 feet in length. Hiawatha ore yields 62 per cent metallic iron, and is low in phosphorus. A shaft is being sunk to test the depth of the deposit. The Hiawatha is about a mile west of the Greinger property, upon which a large body of ore has just been discovered by Pickands, Mather & Co.

Welcome Hyde and associates, who recently secured an option on eight forties adjoining the Ludington mine on the north and west, have decided to explore for ore. An order has been placed for a plant of machinery and a working shaft about six feet square will be sunk about 250 feet west of the old Ludington mine.

Iron Mountain and Menominee, Mich., parties have located a considerable deposit of ore in Dickinson, Co., Mich., in township 43, range 29. Eight forties have been leased from the Ford River Lumber Co., and the Lake Superior Ship Canal & Railway Co. The main ore body was located at a depth of nine feet. Analysis of surface ore showed 45 per cent iron, 38 per cent silica, and .007 phosphorus. Samples from the bottom of a pit, at a depth of nine feet, show 60 per cent iron and a low percentage of phospherus. The find is considered a very important one.

The Vonnegut Hardware Co., of Indianapolis, Ind., reports an increase in business thus far of about 50 per cent over the corresponding period in 1898. The trade of the company in machinery supplies extends all over the central portion of the country. It also deals largely in hangers, pulleys, wire rope, foundry and other tools, and is agent for the Norton Emery Wheel Co., the Crescent Steel Co., and the Lodge & Shipley Machine Tool Co. The house has been established since 1852, and at present employs about 50 men

THE Virginia Iron, Coal & Coke Co. is repairing its furnace near Bristol, Tenn., and expects to blow it in about Sept. 1. It has an annual capacity of about 45,000 gross tons.

THE IRON AND STEEL CONSOLIDATIONS.

The special iron and steel letter of Seymour, Johnson & Co., of New York, to Denison, Prior & Co., Garfield Bldg., Cleveland, under date of July 24, had the following:

"That the several steel and iron stocks are making money, and big money, too, is most likely, judging from the unanimous reports that the demand for all steel products is apparently as great as ever, and that the mills are sold ahead as far as from six to nine months. It seems a pity, therefore, that while their business is so unquestionably good, that the various companies, the Federal Steel, the American Steel & Wire, the National Steel and others, whose stocks are dealt in in this city, should not make full reports to their stockholders so that an opinion can be formed as to their value as investments. The public can judge as to the credit side of their balance sheets, in a way, from the ruling prices of their products in the market and the probable continuance of the great existing demand, but the public knows nothing as to the cost at which this business is done, or debit side of their balance sheets, and the managements of these companies apparently have no intention of enlightening them. Like the earnings of the Brooklyn Rapid Transit which show gains over corresponding periods of last year, nothing is said as to what it costs to make these increased earnings, or what the net results are. What the public is interested in knowing is the net results; these only the managements know and they do not tell."

Commenting on the notice served by Attorney General Monnet, of Ohio, on the National Steel Co., that it is liable to action under the anti-trust laws of the State, a director of the steel company says: "We do not admit that we are a trust within the meaning of the statutes, since we are not organized to fix prices of Bessemer steel or to restrict competition. We believe that the State of Ohio can do nothing except to compel us to take out a license to do business in the State as a foreign corporation, and we are perfectly willing to do that. Our plants in Ohio are there to stay, and we do not intend to move out of them, as we are assured that our business is legitimate in every way. The crusade against corporations, I am informed, has already driven more than $200,000,000 of capital out of Ohio, and I believe that the people will soon put a stop to it."

Closing quotations on iron and steel stocks at Chicago on July 25 were as follows: National Steel, preferred, 91¾; common, 50. American Tin Plate, preferred, 85; common, 38½. Closing quotations at New York on the same date were: American Steel Hoop, preferred, 77½; common, 32. American Steel & Wire, preferred, 96; common 56¼. American Tin Plate, preferred, 85⅛; common, 38½. Federal Steel, preferred, 80¼; common, 58¼. National Steel, preferred, 91½; common, 50. Republic Iron & Steel Co., preferred, 63; common, 16½. Tennessee Coal, Iron & Railroad Co., 69.

The Soil Pipe Consolidation.

The officers of the Central Foundry Co., the recently organized consolidation of soil pipe manufacturers, were announced this week. The names, with present connections, are as follows: President, John Reid, vice president and general manager of the J. L. Mott Iron Works; first vice president and general manager, Alfred Fowle, Jr., of Rundle & Spence Mfg. Co, Milwaukee; second vice-president and supervisor of foundries, Robert A. Regester, of J. Regester & Sons, Baltimore; secretary, G Schumacher, of the Hoffman, Billings & Weller Mfg. Co., Gadsden, Ala.; purchasing agent, W S. Reins, of the Henry McShane Mfg. Co.; treasurer, W. L. Rogers. The executive committee is composed of John Reid, Albert Fowle, Jr., G. Schumacher, R. A. Regester, A. L. Swett, of the Swett Iron Works, Medina, and H. H. Henderson. Mr. Henderson was one of the principal promotors of the consolidation.

For the board of directors the following names have been decided upon thus far, in addition to those given above as members of the executive committee: Theodore Ahrens, of the Ahrens & Ott Mfg. Co., Louisville; F. Whittle, of the Bidwell Mfg. Co., Medina, N Y.; E. E. Weaver, of the Midvale Foundry Co., Allentown, Pa; J. F. Moore, of the Monitor Iron Works, New York; C. F. Smithers, of F. S. Smithers & Co.; Joseph Lodge, of the Schuster Foundry, South Pittsburg, Tenn.; A. D. Jones, of New York; and C. R. Schmidt, of the Phoenix Foundry & Mfg. Co., Lansdale, Pa.

The management says in its announcement: "It is the intention of the management to pursue a very liberal policy towards the jobbing trade, and it is hoped that the company can market its product almost exclusively through them, and that it will not be compelled to go to the retail trade for business. Special attention will be paid to building up an export trade."

Personal.

Frank S. Slocum, for the past ten years chief chemist at the Jones & Laughlins works, Pittsburg, South Side, will become superintendent of the open hearth department. His brother, Harry Slocum, succeeds him in charge of analytical work.

Nicholas Danilevski, managing director of the Pontileff Iron and Steel Works, St. Petersburg, Russia, and his brother, Alexander Danilevski, are visiting the United States to study steel works practice.

S. N. D. North, of Boston, who has proved a worthy successor of John Lord Hayes, as secretary of the Wool Manufacturers' Association, has been appointed chief statistician, in charge of the Division of Manufacturing and Mechanical Industries for the census of 1900.

E. W. Oglebay, of Oglebay, Norton & Co., of Cleveland, sails this week for Europe.

Edward T. Clymer, for several years manager of the two furnaces of the Allentown Iron Co., at Allentown, Pa., and for some time past manager of the charcoal furnace of the Antrim Iron Co., at Mancelona, Mich., will return to Allentown and again have charge of the furnaces there.

David Giles, of Chattanooga, Tenn., has been appointed manager of the United Cast Iron Pipe & Foundry Co.'s plants at Chatanooga, South Pittsburg, Tenn., and Bridgeport, Ala., and L. Giles, assistant manager. J. Hill is made assistant superintendent at South Pittsburg. J. K. Dimmick is made general manager of the Bessemer and Anniston, Ala., plants. Eugene B. Thomasson and J. R. Rice are appointed salesmen for the five plants.

Obituary.

Samuel M. Shimer, well known for years as a dealer in iron and steel and old material, with offices at 310-11 Perry-Payne Bldg., Cleveland, died on July 23, after an illness of a few days. He was 38 years old and a native of Delaware county, Pa. Mr. Shimer started in business in Cleveland in 1886 and in the interval has had important connections in various departments of the trade, his industry and talent being well rewarded. He leaves a wife and daughter. His brother, John N. M. Shimer, is connected with L. & R. Wister & Co., of Philadelphia, and the Dunbar Furnace Co., of Dunbar, Pa.

The Sinker-Davis Co.—This widely known establishment was organized about 50 years ago in Indianapolis, Ind., and ever since has continued in the same line of business. It is an extensive manufacturer of saw-mill outfits, engines, boilers, etc., and its goods have always maintained a high reputation and given excellent satisfaction. The specialty of the Sinker-Davis Co. is the furnishing of complete machinery for hardwood saw-mills and these outfits are extensively used throughout the Southeast and South. The company recently shipped a three-carload outfit to Honduras in Central America, which will give some idea as to the extent of its operations. There has been a large increase in its business during the present year, and it is now working 200 men from 10 to 12 hours a day. It is one of the oldest concerns of its kind in the Central West.

A DENIAL from President Felton, of the Pennsylvania Steel Co., of the report of negotiations by that company for the Cornwall iron mines near Lebanon, Pa., is printed in the newspapers. It is expected that the Pennsylvania Steel Co. will increase its imports of Cuban ore by another year.

IRON pump manufacturers, representing 22 plants, met at Chicago July 20 and a further advance in prices was decided upon in view of the advance in materials. S. S. Gould presided at the meeting.

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PIG IRON STOCKS AND PROSPERITY.

Comment has been freely made by the writers of the daily press on Mr. George H. Hull's article entitled "The Relation of the Price of Pig Iron to Commercial Prosperity," which appeared in the *North American Review* for July. Many of these editors, who are not as familiar as the iron trade is, with Mr. Hull's interest in promoting speculation in pig iron, have treated the article purely as a contribution to economic literature. Some of them have actually found novelty in the proposition he has been urging for years in one garb or another upon the iron manufacturers of the country, but never so attractively as to win them to it. The argument as it is presented this time is that no commodity of importance is subject to such conditions of inadequate supply and excessive advance in price, as are shown in the history of the iron trade. Rejecting the long entertained notion that iron is a barometer of trade, an index of conditions existing in the financial and industrial worlds, Mr. Hull argues that events in the iron trade have been causes, and various occurrences in trade and industry, direct effects. Strangely, while making conditions in the iron trade responsible for disaster and depression in the business world at large, he does not credit them with producing any of the prosperity that has come to the country from time to time. He should have explained, for example, why general prosperity did not follow the iron boom of 1895. The drift of the article, or that portion of it in which the foundation is presumably laid for Mr. Hull's well remembered preachment, is about this: Consumption of iron has been growing rapidly in the United States. The per capita was 100 pounds a year 50 years ago; to-day it is 400 pounds a year to the person. Whatever restricts iron consumption limits to that extent the people's prosperity. Every period of prosperity in the past 50 years has been checked soon after an abnormal advance in the price of pig iron. Such advances occurred in 1854, 1864, 1872, 1880 and 1889, and another is now under way. With the small stock of iron usually carried in this country, it is impossible to stop these excessive advances. They result in the stoppage one by one of such enterprises as cannot be continued at famine prices for iron. Men are discharged. Consumption of other materials is restricted. Manufacturers catch up with orders at length; stocks increase; prices fall; confidence is lost; failures increase; then comes the panic.

The article, as may be judged, is a good example of the facility with which trade and industrialm ovements may be explained if the diagnostician is permitted to pick his causes and lets the conclusion he would reach govern him in assorting them with the effects. Out of a score of influences some or all of which may be traced in connection with the prosperous periods referred to above, the writer chooses to name one which he treats as a great controlling cause. With equally good reason it may be treated as one link in a chain of causes, or as an effect of influences exerted upon the iron industry and all others.

But to the remedy: Members of the iron trade need scarcely be told that Mr. Hull finds it in carrying "an ample supply of iron," storing it in warrant yards and creating free speculation in certificates representing the stored stocks. The notion that adjustments between supply and demand are made in response to general conditions is to be superseded. Mr. Hull refers to "a score of efforts made in the past 20 years to restrict production" and confesses that in heading one of them he did a very unwise thing. Then he advocated reducing production so as to bring it in equilibrium with demand. Now he would have us believe that the way to insure perpetual prosperity in the iron trade and in all industry is to make and keep on making more iron than the country consumes. Artificially decreasing production is hurtful; artificially increasing production is a panacea for industrial and commercial ills.

It might be asked why the iron trade, that presumably includes some of the most capable business minds in the country, has been so dull of sight, that it has not seen and applied this remedy. The only answer is that like every other industry, it is controlled by forces that no programme of artificial supply or lack of supply can change. The reason there is no three months' or six months' supply of iron on hand in the United States is that no investor with money and sense has been willing to manufacture that for which there was no promise of an early or even a remote need. What British iron masters have done, under the steady evolution from the days when Great Britain made iron for the world to a time when she faces competition in every quarter, is no pattern for the United States. And that the warrant stocks carried in Scotland have not resulted as Mr. Hull affirms, in preventing any but wholesome advances of 10 to 15 per cent, appears in the market quotations of recent weeks. No. 3 foundry, at Middlesbrough, went from 40s 6d on July 15, 1898, to 71s July 15, 1899, nearly all the

advance having been made in the first six months of this year.

Whatever may be the British habit, under ordinary conditions, it is a characteristic of American business men that they elect to operate under the alternations that have marked American business in the years following the war. A dead level would not be chosen, if it could be had. And if there have been but five periods of rapid advance in iron in over 40 years, even granting what is said of the resulting evils, why adjust every-day conditions in the trade so as to avoid these, when, as Mr. Hull admits, it has been necessary to make "a score of efforts in the past 20 years, to restrict production" because iron was a drag and prices gave no profit. If the lean years are so far in the majority, and that is the fact, why take steps to prevent advances to good profits in the occasional years of prosperity?

It is to be remembered in connection with the considerations Mr. Hull presents, that there has been at work in the iron industry of the United States a steady and unexampled reduction of costs, due to improvement in practice, discoveries of cheaply mined ores, and other causes well known. In England the influences have been the other way. The influence of large stocks in England has been counteracted by appreciation of costs. The fluctuations in the United States have been accented because of a variety of influences at work tending to minimize prices, particularly in time of depression. Thus the amplitude of vibration has been greater here, but it is not due so much to the causes Mr. Hull assigns, as to others.

It will take more than has been advanced thus far, in the attempted campaign of education, to convince the American iron trade that its prosperity is dependent upon a glut of pig iron, artificially produced for the sake of furthering speculation.

Large Iron Mine and Vessel Deal.

On Friday of this week papers will be passed in one of the most important transactions in the history of the Lake Superior ore trade, marked, as it has been in the past few years, by changes that have amounted to revolution. For several months the negotiations have been under way which have ended in the acquisition by the National Steel Co. of the well-known Chapin and Winthrop mines and the steel fleets of the Mutual Transportation Co. and the Menominee Transit Co. All these properties are familiarly known in the trade as allied to the Hanna interests, and Mr. L. C. Hanna, who is the active head of M. A. Hanna & Co., has represented in the negotiations the various owners of both mining and vessel properties. On the part of the National Steel Co. the deal has been conducted by President W. E. Reis. It is a fact worth noting that from beginning to end there has been no inspection of the mines by appraisers, and the determination of all valuations, indeed, has been one of the most readily solved problems connected with the transaction, Mr. Hanna's capacity in some phases of the deal being really a dual one. All the properties were well known and their value well attested. The National Steel Co. has acquired almost all the stock of the following companies:

Chapin Mining Co., holding a 20-year lease, dating from 1894, of the famous Chapinmine of Iron Mountain, Mich., Menominee range.

Winthrop Iron Co., owning the fee of the Winthrop mine in the Ishpeming, Mich., district, Marquette range. The company has in fee 160 acres of mineral lands and in addition 80 acres of surface lands.

The Mutual Transportation Co., of Cleveland, owning the steel steamers Coralia, Corsica, Corona and Cambria, also an interest in the P. Y. & A. docks at Ashtabula, O.

The Menominee Transit Co., of Cleveland, owning the steel steamers Grecian, Roman, German, Saxon and Briton.

The vessels above named have been in the ore trade for a number of years. Their capacity in the Escanaba trade, in which they will be employed as heretofore, is easily 1,000,000 gross tons of ore in a season.

With the two mines acquired in the deal the iron trade is quite familiar. The Chapin, known as the largest single producer of iron ore in the United States has to its credit 7,499,450 tons, its first shipments being made in 1880. It is capable of 900,000 to 950,000 tons a year, under existing conditions. Sales for the present year were close to 850,000 tons. At the beginning of the present year there were between 4,000,000 and 5,000,000 tons of ore in sight and the reserves are considered enormous. The ores are favorites with furnacemen and have always been in great demand. The Chapin grade runs 61.60 in iron, .065 in phosphorus, 4.96 in silica, 2.20 in magnesia and 6.84 in moisture. Though not strictly a Bessemer ore, it is a large component of Bessemer mixtures. The Rex, or second grade ore, is 57.54 in iron, .066 in phosphorus, 6.26 in silica, 3 93 in magnesia and 7 in moisture. The Winthrop property has vast quantities of ore in sight and in reserve. Mining is from open pits. A portion of the ore forms the silicious element in Bessemer and foundry mixtures and another portion is well adapted to basic uses. The Bell grade runs 41.18 in iron, .030 in phosphorus, 37 22 in silica, and 2.26 in moisture. The Marquette is 41.6 in iron, 0.55 in phosphorus, 36.85 in silica, and 4 37 in moisture. The Winthrop is good for 300,000 tons a year, and thus the two mines will furnish readily about 1,250,000 tons of ore a year. The Winthrop began shipping in 1890 and its total output is 1,236,814 tons.

No meetings of the board of directors of any of the four companies has been necessary in the progress of the deal, negotiations being carried on with stockholders in every instance. The fee of the Chapin, as heretofore, remains with the Chapin estate. There is a graduated royalty, gauged to the selling price of ore, the minimum being 10 cents, and under to-day's price of ore being somewhere in the twenties.

It is a stipulation of the transaction just closed that M. A. Hanna & Co. shall handle the various properties involved, as heretofore, the firm's long experience and excellent organization both in ore and vessel departments being thus at the disposal of the steel company, which has no office in Cleveland.

With the Chapin and Winthrop, the National Steel Co. has about 80 per cent of its requirements in its own hands, having in addition the Oliver one-sixth of the Oliver Iron Mining Co.'s ores, an interest in the Biwabik mine and a term contract for Adams ore. Its requirements are about 3,000,000 tons.

JAMES P. GARDNER, of Cincinnati, prepared the descriptive matter, which is complete and interesting, for a pamphlet of 65 pages, entitled "Collieries and Furnaces of the Ashland Coal & Iron Railway Co., of Ashland, Ky." In addition to a number of creditable half tone views of the property, the book contains sketches and illustrations of characteristic views along the C. & O. Road. The early history of Northern Kentucky is traced in the introductory matter relating to the important iron and steel industries at Ashland.

THE 8,000-net-ton mark has been passed in the ore cargo record. The steam barge Manila of the Minnesota Iron Co.'s fleet delivered 7,399 gross tons or 8,237 net tons of ore at South Chicago last week. Just 12 hours was required for unloading. The load was taken from Two Harbors and the barge was drawing 18 feet of water. The Manila is 436 feet keel, 50 feet molded beam and 28½ feet molded depth.

AT Buffalo the American Malleable Castings Association held its second annual meeting last week. O. P. Letchworth, of the Pratt & Letchworth Co., presided.

BOILER MANUFACTURERS' ASSOCIATION.

The eleventh annual convention of the American Boiler Manufacturers' Association began its sessions in the banquet hall of the Hollenden Hotel, Monday morning, July 24, with an attendance larger than usual on the first day. Special interest attached to this convention in view of the meeting of boiler manufacturers at Pittsburg a few months ago, attended by members of the association and non-members, at which the question of consolidation as a remedy for evils long recognized in the trade was under consideration. The adjournment of that meeting was with the understanding that the matter was to be further pursued at the Cleveland convention, communication being had in the meantime with manufacturers whose views had not been ascertained. So far as business sessions are concerned this effort to bring about a better condition in the trade has had right of way in the present convention, and executive sessions to which only boiler manufacturers were admitted have consumed the afternoons of the first two days' sessions. The list of those in attendance is as follows:

H. J. Hartley, Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia.

Geo. R. Lombard, Lombard Iron Works, Augusta, Ga.

Frederick R. Case, Hoopes & Townsend, Philadelphia.

D. Grupe, Davenport, Ia.

Jos. F. Wangler, Jos. Wangler Boiler Works Co., St. Louis.

Louis D. Collins, New York Central Iron Works, Geneva, N. Y.

T. R. Teare and M. Thomas, River Machine & Boiler Works, Cleveland.

James Lappan, James Lappan & Co., Pittsburg.

Geo. Whiting, Scully Iron & Steel Co., Chicago.

J. Don Smith, Valk & Murdoch Iron Works, Charleston, S. C

Chas. Hooper, Union Iron Works, Erie, Pa.

J. F. Corlett, Cleveland (Lukens Iron & Steel Co).

M. Weidner, Walch & Weidner, Chattanooga, Tenn.

John H. Early, American Steel & Wire Co., Cleveland.

Columbus Dill, Ashton Valve Co., Boston, Mass.

J. D. Hurley, Standard Pneumatic Tool Co, Chicago.

W. J. McAleenan, McAleenan Boiler Co., Peoria, Ill.

E. J. Walsh, Tobin & Hamler Mfg. Co., Chicago.

T. E. Tucker, Gem City Boiler Works, Dayton O.

J. B. Campbell, McNeil Boiler Works, Akron, O.

Richard Hammond, Lake Erie Boiler Works, Buffalo, N. Y.

A. B. Hambleton, American Shipbuilding Co., Cleveland.

Geo. N. Riley, National Tube Co., Pittsburg.

J. H. Webster, Variety Iron Works, Cleveland.

W. O. Duntley, Chicago, and C. W. Laughlin, Pittsburg, Chicago Pneumatic Tool Co.

Ed. S. Page, D. J. Champion, S. A. Byerley, Frank Byerley, Champion Rivet Co., Cleveland.

J. D. Clary, Bourne-Fuller Co., Cleveland.

J. R. Brownell and J. R. Brownell, Jr., Brownell Co., Dayton. O.

Geo. Bartol, H. Jeavons, H. F. Deverell, W. J. Walker, John Newey, Otis Steel Co., Cleveland.

W. A. Rarig, Rarig Engineering Co., Columbus.

Dan Connelly, W. Connelly, L. Connelly, Cleveland Steam Boiler Works, Cleveland.

J. D. Farasey, J. H. Kennedy, H. E. Teachout Boiler Works, Cleveland.

Carl C. Harris, Illinois Steel Co., Cleveland.

Geo. Stanton, Q. & C. Co., Chicago.

F. H. Hart, Cleveland Steel Co, Cleveland.

J. F. Malloy, Mutual Boiler Co., Boston, Mass.

James Morrison, Pittsburg.

James A. Dumont, Inspector General, United States, Washington, D. C.

Robert Joy, Kingsford Boiler Works, Oswego, N. Y.

James McGrath, Government Inspector, Cleveland.

E. P. Robinson, Atlantic Works, Boston, Mass.

E. I. Leighton, Cleveland Punch & Shear Works, Cleveland

J. R. Mills, Jr., E. C. Collins, Carnegie Steel Co., Ltd., Cleveland.

L. W. Fawcett, *Iron Age*, Cleveland.

H. F. Cook, H. H. Prange, McNeil Boiler Works, Akron, O.

H. A. Freeman, Ashton Valve Co., Chicago.

C. W. Leonard, E. Leonard & Sons, London, Ont.

Cliff M. Tudor, Tudor Boiler Works, Cincinnati.

E. T. Hannan, Hawley Down Draft Furnace Co., Cincinnati.

John M. Mulrooney *Marine Review*, Cleveland.

Capt. Geo. L. DeWolf, Cleveland, inspector steam vessels.

John Murphy, Lake Erie Boiler Works, Cleveland.

Fred. Deitz, Bassett, Presley & Train, Cleveland.

Fred. Cook, Geo. Hirsch, W. H. Teare, John Weber, River Machine & Boiler Works, Cleveland.

John O'Brien, John O'Brien Boiler Works, St. Louis.

E. S. Mills, Carnegie Steel Co., Cleveland.

Robert Wallace, American Ship Building Co., Cleveland.

A. I. Findley, *The Iron Trade Review*, Cleveland.

Chas. Freeman, S. Freeman & Sons Mfg. Co., Racine, Wis.

A. M Castle, A. M. Castle & Co., Chicago.

Chas. Collisi, Ishmael Jones, H. E. Teachout Boiler Works, Cleveland.

Monday, July 24.

The convention was called to order at 10:30 Monday morning by President H. J. Hartley, of Philadelphia. His annual address reviewed the work accomplished by the association in establishing specifications for boilers, the report of the committee that had labored faithfully on this problem for two years having been adopted last year at the St. Louis meeting. The alternative was now presented of going seriously into a movement calculated to benefit the manufacturers by putting the business on a better financial footing, or of continuing the association merely for the social features and the informal discussions of topical questions at its annual meetings.

A welcome to the city was extended on behalf of Mayor Farley by M. W. Beacom, assistant corporation counsel, who in extending the freedom of the city to the delegates explained that the mayor was occupied with responsibilities growing out of the street car strike. A welcoming address on behalf of the Cleveland boiler manufacturers was made by J. H. Webster, of the Variety Iron Works, Cleveland. In the absence of Col. E. D. Meier, of St. Louis, so long the association's efficient secretary, the response was made by James Lappan, of Pittsburg.

Monday afternoon's session was given up entirely to the discussion of ways and means for the betterment of the trade. The report of the executive committee and that of Secretary Farasey were presented, and the steps thus far taken were detailed. Letters and telegrams from firms not represented at the convention were read, indicating their views on the consolidation proposal.

Tuesday, July 25.

Tuesday morning's session was an open one, the order being the discussion of topical questions. The only one taken up was the following: "What are the advantages in building a large boiler, in having the bottom in one plate, as compared with a boiler of two, three or more rings?" The chief advantage, it was agreed, was in the greater ease of cleaning. It was urged by some that the boiler with one plate in the bottom was more economical than a sectional boiler, but this was disputed by others.

Two committees were announced at the morning session: that on nominations, consisting on Geo. N. Riley, Jos. F. Wangler and J. B. Campbell, and that of place of next meeting, consisting of J. Don Smith, Wm. Weidner, and J. B. Campbell.

In the afternoon the executive session of Monday afternoon was continued, and details were referred to the executive committee, which held meetings in the intermissions between regular sessions Meantime the ladies who accompanied the delegates were driven about the city in carriages, being entertained by the local committee of ladies. Tuesday evening was spent at a garden theatre, delegates and ladies being under escort of the local reception committees.

Wednesday, July 26.

For the third day an outing had been prepared. The delegates and guests with their friends, making a party of 150, were taken in special train to Sandusky. There the steamer A. Wehrle, Jr., received the party on board, and they were taken to Cedar Point for lunch. In the afternoon, Kelley Island, Middle Bass and Put-in-Bay were visited. Returning to Sandusky at 5:30 the excursionists were dined at the Sloane Hotel. At 8:30 p. m a special train took them to Cleveland.

The concluding session on Thursday morning was scheduled for business: Choosing place of next meeting; electing officers and acting on unfinished matters. It is believed that the convention made substantial progress toward the realization of more tangible benefits than have been secured heretofore.

Review of the Technical Press.

BY DR. RICHARD MOLDENKE.

By-Product Coke Ovens [*Engineering*, June 23.]—Mons. E. Coppeé read a paper on this subject before the Mining and Metallurgical section of the Institution of Civil Engineers. He first calls attention to the strong demand for coke and the advisability to increase the producing capacity in this line while the profits are large and certain, this in spite of the building of 1,500 new coke ovens in Russia, for 1899, not mentioning England and the United States. Since by-product ovens are the most economical the increased capacity will doubtless (in Europe) be provided for by this class. Mons. Coppeé describes the working of some of his latest recovery ovens, claiming that they make as good a quality of coke as the beehive, that the coal is roasted perfectly, about 28 to 30 tons being coked per week per oven. The amount of gas made with coal having 25 per cent volatile matter is nearly 15,000 cubic feet per 24 hours for a 4-ton oven. The gases after passing out of the flues of the by-product ovens have a temperature of 1,800 to 2,200 degrees F., and this heat when utilized under steam boilers generates enough steam to amount to 2½ h. p. per ton of coke produced. Mons. Coppeé gives cost comparisons between the regular beehive, his own improved oven, and his by-product oven. The figures run 12¼, 10½, 6⅝ to 6½. That is, with the sale of the by-products the cost of the ordinary method may be cut nearly in half. In conclusion the claim is made that inferior coke in by product ovens, which is usually given with dry coals, can be readily rectified by emptying the system of heaping before treating in the horizontal furnace. With the true coking coal recent progress has left nothing to be desired from the product of the new system.

In discussing the paper Sir B. Samuelson suggested that the mixing of dry with rich bituminous coals be looked into more than it is when using by-product ovens. By doing this a great advance had been made in the quality of the coke produced. Mr. David Evans stated that English coke from by-product ovens was not as good as that from the Continent because of this absence of mixing the proper kinds of coal together to get the best results. In Westphalia they had special machines to get intimate mixtures of the proper grades of coal selected as the result of experience. Sir Lowthian Bell describes a number of experiments made in coking and argued the matter of saving by-products from the standpoint of the political economist. To intercept the enormous waste of materials valuable for agricultural purposes, even if it meant but little advantage to the iron master, would be an ultimate benefit to the country at large. Mr. Martin had found that the volatile matter in a coal did not govern its coking qualities. Mr. Stead brought up the question of what action carbonic acid had in the formation of retort carbon on the surface of the coke, and suggested that if it were possible to take the hydrocarbons from another oven and pass these gases through the already formed coke, an advantage would be gained. Mr. Louis did not want the by-products in the shape of a coating on coke, there was more money in condensing the hydrocarbons and selling the benzol in the market. Mons. Coppeé, in concluding the discussion, ventilated the labor questions of England and Belgium. It seems that in two coke ovens, each with 80 furnaces, in Belgium and South Wales, the same number of men who in Belgium charged these furnaces daily all the year around would only take care of 60 in South Wales every day in the week, and still less on Sundays and holidays. In the new by-product coke ovens of his system the circulation of the gases was so arranged that the gases were burned in the lower part, thus engendering the highest heat there and leaving the top cool enough not to crack up the hydrocarbons. In mixing coals a good mixture was found to be 50 per cent bituminous coal and 50 per cent steam coal. This resulted in an average material containing 18 per cent volatile material, the mixture being best effected in the coal washing plant. Another mixture which worked well was 65 per cent bituminous coal and 35 per cent anthracite.

The Casting Temperature of Steel. [*Engineering*, June 23.]—Mr. R. A. Hadfield contributed a paper on the influence of the casting temperature upon steel, before the engineering conference of the Institution of Civil Engineers, in which he called attention to the difficulty of obtaining data even with the latest and best pyrometers. Mr. H. H. Campbell has found that a difference of 40-50 degrees F. in the ladle of steel makes an appreciable difference in the castings. For instance the addition of 100 pounds of scrap to a 7-ton bath makes a perceptible difference in the heat, and 200 pounds is the maximum variation allowed in the original charge of a furnace; otherwise the product will suffer. These very narrow limits could be held in good shape were there a good pyrometer available. If the steel is too hot the ingots pipe too much and segregation is also too marked. If too cold, the ingots do not come out satisfactorily and will not forge well. Crucible steel, which is overheated and cast, shows an appearance which is called "scalded." Careful reheating seems to mitigate the evil a little, yet the best makers remelt this steel in place of reheating and using it. The greatest care must therefore be used to get the casting temperature of steel just right. Mr. Hadfield gives a number of temperatures taken during the progress of some industrial operations, among which the O. H. process is of interest. In making steel with 0.30 carbon the temperature at the end of fusion period of cast iron in the bath showed 2,590 degrees F.; at the refining point of steel 2,730 degrees; in the ladle 2,875 degrees at the commencement down to 2,720 degrees at the end. In the ladle from a 6-ton converter the steel was at 2,980 degrees F. In the discussion Mr. Hadfield pointed out the fact that American universities were giving instructions in the use of pyrometers for measuring high temperatures. Mr. Stead did not agree with Mr. Hadfield so far as the crucible process was concerned; here it was important to get the proper heat and pour at once. A scalded ingot was all right provided it was not honeycombed, so that unless piping accompanied scalding the ingot could be used.

WORLD'S OUTPUT OF PIG IRON AND STEEL.

In the recently issued monograph prepared by General Manager James M. Swank, for the U. S. Geological Survey, on "The American Iron Trade in 1898, and the Foreign Iron Trade in 1898 and Immediately Preceding Years," appears the table given below. It gives the production of pig iron and steel in all countries in 1898 or in the most recent year for which statistics have been received. English tons of 2,240 pounds are used for Great Britain, Canada, the United States, and "other countries," and metric tons of 2,204 pounds for all other countries, metric tons being used as the equivalent of English tons in ascertaining the total production for all countries. Their appearance in the pamphlet is the first publication of these important statistics in their entirety:

WORLD'S PRODUCTION OF IRON AND STEEL

Countries.	Pig Iron.			Steel.		
	Year.	Production	Per cent-age.	Year.	Production	Per cent-age.
		Tons.			*Tons.*	
United States	1898	11,773,934	33.02	1898	8,932,847	37.03
Great Britain	1898	8,631,151	24.31	1898	4,665,986	19.33
Germany and Luxembourg	1898	7,232,988	20.29	1898	5,779,570	23.96
France	1898	2,531,427	7.11	1898	1,473,100	6.11
Belgium	1898	979,101	2.75	1898	653,130	2.71
Austria and Hungary	1897	1,308,493	3.67	1896	880,696	3.65
Russia and Finland	1898	2,191,750	6.15	1897	1,153,000	4.78
Sweden	1897	538,197	1.5	1897	275,126	1.14
Spain	1898	261,799	.73	1898	213,015	.88
Italy	1897	8,393	.02	1897	63,940	.27
Canada	1898	68,755	.19	1898	21,540	.09
Other Countries	1897	125,000	.35	1897	15,000	.06
Total		35,655,988	100.00		24,126,962	100.00

Monarch Governor & Machine Co.—The Monarch governor, manufactured by the Monarch Governor & Machine Co., Inc., of 740–750 East Washington st., Indianapolis, is built with an automatic safety stop, speed adjuster and valve lever. It is adapted to all varieties of steam engines and is fitted with special valve chambers to suit any style of gas engines of the throttling type. The valve throw of the governor is adjustable independently of the radial throw of the governor balls, so that very close regulation is obtained for any engine or motor on which a throttling governor can be used. The automatic stop is positive and is adjustable to any angle of the driving belt, whether horizontal or vertical.

METHODS FOR THE IRON LABORATORY.—VI.

BY FRANK L. CROBAUGH, CLEVELAND.

[The following is the concluding installment of Mr. Crobaugh's articles. It was written originally as an introduction to the details of analyses of the various metalloids, but was omitted because of the necessity of abridgement. Its appearance now seems necessary to the completeness of the series.—Ed.]

It seems fitting for me to record the more important methods employed in the analysis of iron ore, pig iron, steel and incidental products, in such form as they are most valuable to me. This record may be of service to the beginners in the work. The methods described in detail are those which, after a critical study of texts and papers to which I have had access, seem best adapted to rapid work without sacrifice of accuracy. Following each method will be found results obtained by it, compared with results on the same sample by other methods or operators.

Beginners are usually confronted by an inability to select methods which will serve them in time and accuracy to meet commercial demands. They cannot often find in texts how closely their results must agree with those of other chemists operating upon the same sample, hence figures are given.

I shall style for convenience in the remainder of my paper, works by "Blair," "Lord" and "Troilus", Common References. I shall make no further attempt to assign credit for ideas used except in such instances as a study of the reference seems necessary to an understanding of the methods as I use them.

A volume containing methods for the analysis of ore, pig iron and steel, printed by the Chemical Publishing Company, of Easton, Pa., contains a description of methods used in the laboratories in and about Pittsburg. To the above work and to the *Journal of Analytical and Applied Chemistry*, which is now merged into the *Journal of the American Chemical Society*, I would refer the reader for the less important methods, to which I make no allusion.

Following a few ideas on sampling and preparation of samples, the first five methods described are for the determination of iron, phosphorus, manganese, lime and lulphur. They all depend upon the use of a standard solution of potassium permanganate, for which reason I call them a family of methods.

In my experience the solution of permanganate is more easily standardized absolutely than any other solution employed in this class of work. It is the basis of a great volume of other volumetric methods. The permanence of a standard solution of potassium permanganate is made evident by the following data:

An aged solution titrated
Sept. 2, 1898, 39.7 c. c.—1.4 gm. ammonio ferrous sulphate.
Sept. 15, 1898, 39 7+
Oct. 3, 1898, 39.7—
Oct. 19 1898, 39.7
Nov. 3, 1898, 39.7
Dec , 1898, 39.8
when it was nearly consumed.

The last portions of a standard solution are more subject to variation. To attempt such results the solution must be prepared and standardized as follows: A solution containing 2½ grammes of potassium permanganate per litre is of convenient strength for the five methods. Place "N" grammes of the salt in a measured volume of water, by shaking or by aid of blast of air, hasten its solution. When complete allow the solution to age several weeks. The salt may be the commercial article—the water any ordinary tap water. At the end of this aging the clear supernatant liquid should be syphoned from any residual mineral matter, and is ready for use. Were it desired to make a solution for almost immediate use, distilled water and chemically pure salt should be employed. This solution should be brought to boiling for several minutes. It will be ready for use the next day. Its value will not remain as constant as that of the former.

The containers of the permanganate solution, as well as the tubes leading from the same, should be well painted to avoid decomposition of the solution by light. Statements that permanganate solution can not be conveyed unchanged through rubber connections are not well founded, as in obtaining a list of titrations given, a side-filling burette was used incident to which were two short rubber connections. Such connections become coated almost immediately with oxide of manganese, which prevents further action upon the rubber. Before using apparatus of this kind, connections should stand filled with solution over night, which, when drawn, leaves the train ready for use. Oxalic acid, ferrous sulphate, iron wire, ammonio ferrous sulphate (if of proper quality) may all be used to standardize a permanganate solution. Of these ammonio ferrous sulphate is most available. Correct ammonio ferrous sulphate may often be procured in the market under label "Chemically Pure Ammonio Ferrous Sulphate for Standardizing." It may as frequently be obtained of perfect quality under label "Dry Commercial Ammonio Ferrous Sulphate." It should be kept in rubber stoppered bottles in a dark place. Such samples show no trace of ferric iron and may be either fine or coarse crystals. I have at this time seven varieties of it, varying in age in my hands from one to five years, all of which titate the same with potassium permanganate. When so many varieties of the salt, made under different conditions and at different times, will check with one another, it is evident that the salt is permanent, and that each is the theoretical article.

To obviate any doubt as to this point, we may compare them by aid of a solution of potassium permanganate with ferrous iron obtained by solution of any good iron wire sold for the purpose, which may be called 99 9-10 per cent. iron. For the method of dissolving and treating this iron see Fresinus' Quantitative Analyses, Second American Edition, page 268.

To prepare a correct ammonio ferrous sulphate, dissolve the imperfect sal by agitation in a minimum quantity of distilled water containing not to exceed ½ per cent by-volume of sulphuric acid sp. gr. 1.84, evaporate slightly under cover of watch glass, filter, cool to low temperature, when by constant stirring a mass of minutely small crystals will form, quite convenient to weigh. Decant the mother liquid from the mass of crystals, pour the crystals into a large funnel containing a platinum cone, when by pressure upon the mass or brief suction most of the liquor will be eliminated, wash once with cold distilled water, apply suction and pressure as before. Throw the mass on to filter paper several sheets in thickness, distribute evenly over surface of same, cover with several sheets of filter paper, press the crystals. Repeat this operation several times, often using new paper, expose the mass between filter paper in a warm, dry atmosphere, not to exceed 90 dergees F., away from the light for 48 hours, changing the position of the crystals on the paper and pressing down any aggregations of the same occasionally during the period, when they will be ready to bottle. Compare them with iron wire. I have often re-crystallized two portions of an original sample, after which they showed no change.

There is no objection to desiccating crystals for a brief time over sulphure acid. A prolonged desiccation will shatter the stability of a crystal and in a longer time abstract a part of its crystal water.

To standardize a permanganate solution, weigh 1.4 grammes of ammonium ferrous sulphate into a beaker of convenient size, add 150 c. c. cold water and 20 c. c. of a cold mixture (one volume sulphuric acid sp. gr. 1.84+ 3 vol. water) hasten solution by stirring, when it is complete titrate at once. The end reaction is very delicate. Its approach may be noted by a faint darkening of the beaker's contents, prior to adding cautiously the last 2-10 to 3-10 c. c. Duplicates should agree either to the exact tenth or to the fractional part of a tenth. More than one variety of the salt should be used in standardizing a solution. Since 1.4 grammes of ammonium ferrou sulphate contains 2-10 of a gramme of iron, multiply the reading of the burette by five and divide this product into one, which will give the value in grammes of iron to which one c. c. of the permangnate solution is equivalent; thus is obtained a permanganate solution standardized in terms of iron, which is the basis of the "family" of five methods. Since 1.4 grammes of ammonio ferrous sulphate is always to be used in standardizing a permanganate solution, we may, for convenience, let R=the reading of the burette, then the iron value=$\frac{1}{5}$ R.

C. E. James and others, of Chattanooga, have bought the Chattanooga Furnace and will start it up.

AN INCREASING USE OF MACHINERY.

The great difficulty of obtaining a sufficient number of machinists to do the work in engineering, shipbuilding and general machinery lines in England is being commented upon by the British technical press. The *American Machinist* expresses some impatience with the explanation we have been hearing so often—namely, that the shops in England are yet being crowded from the overflow of work postponed by the strike in 1897-98:

"No American manager, we think, would have the hardihood to plead a strike of 18 months ago as the cause of delay in filling orders now. It appears to us rather that the vast expansion in the use of machinery is making itself felt in the manner described. It has, in fact, been a constant surprise to us that it has not been so felt before. When the enormous increase in the use of machinery durinn the past 20 years is considered, the question where the machinists to make it have come from is a constant enigma. The entire electrical industry is the creation of that period of time. Had anyone 20 years ago predicted the present vast development of that industry he would have been asked where the men to do the work were to be found, and he could not have answered the question. This industry, it is to be noticed, has created its own field. In most of its applications it has supplanted nothing. Even in lighting, by familiarizing people with better artificial light, it has actually increased the use of gas. In the field of the trolley car it has interfered seriously with horse breeding, but even here mechanically considered, it has called for a new body of men.

"The subject is much broader than it at first appears, for every industry, and the electrical industry especially, supports many others. The electrical development has supplied an enormous market for steam engines and boilers, as well as adding appreciably to the consumption of iron and steel, and very markedly to the consumption of copper and some other materials. Such added consumption has lent its quota to the market for mining and metallurgical machinery, while the management and up-keep of all this equipment have furnished employment for a great quantity of skilled labor. Other, though less important, new industries have had a similar effect, while the tremendous increase in the consumption of iron and steel in building and other operations has tended in the same way.

"In the immediate future is another industry, which, like the electric industry, will create a new demand for skilled machinists—the automobile industry. There can be no doubt that this is to attain large dimensions and that its effects on the labor market will be far reaching.

"To the question, How has this work beun done and how is it to be done? there can be but one answer—through labor-saving machinery. But for such machinery the work of to-day could not be done, and still less can that of the future be done. Were it attempted, the effort would defeat itself through the increased cost of the articles produced. Through the use of such machinery the bicycle, for example, has been brought to its present price. It is clear enough that were the manufacture of bicycles conducted by hand processes and by the skilled labor that such processes involve, the cost would be so enhanced as to put it beyond the reach of nearly all who now enjoy it. In the same way there can be no doubt that the present immense consumption of all mechanical products is largely due to the cheapness of production by labor-saving machinery.

"Meanwhile this same labor-saving machinery must be made, and in its production by general consent our country is pre-eminent. Developed originally to meet our own needs, it has now found a new and unexpected markt abroad. At home its production has employed large numbers of men, and now still more employment is being supplied in equipping foreign shops. In the foreign field, American automatic machine tools, like electrical machinery in the home field, have created a market of their own and supplied employment to thousands, while at the same time putting our country in the forefront of producing nations. Surely if any one has reason to think kindly of labor-saving machine tools it is the American mechanic. This is the age of machinery, and the future is to be still more so. Of all trades, that of the machinists, and of all machinists, the American is the most secure As we have said before of the machinist, all streams of improvement bring grist to his mill, and just now most of the streams lead to the United States."

Ore, Coal and Grain Rates on the Lakes.

We have referred to the increasing probability of a falling off in ore shipments from Lake Superior mines, from the estimate made early in the season, and to the fact that 14,500,000 tons is now more generally talked of than 16,000,000 tons. The *Marine Review* thus refers to the bearing of this condition on the lake freight situation: "In the meantime the ore companies have gone on paying high freights and hurrying stock pile ore down the lakes, simply for the purpose of being absolutely certain of avoiding the 'boom' that may come on with a heavy fall grain movement. They realize that the movement of freight in all other lines is heavy and that there is no telling how high freights might go in event of a big demand for grain carriers. The soft coal shippers, who are so very much behind in their output, have reason to take some encouragment from this situation as regards the ore, but on the other hand they are met with the conditions as to late shipments of grain which the ore shippers are straining every effort to avoid. It follows therefore that nobody connected with the lake trade is venturing predictions these days. As the freight market has been steadily rising since the first week of navigation, the ship owner refuses to make any engagements for the future, and the situation from day to day is all the time one of more cargoes than vessels. To sum up the present outlook, it may be said that the ore dealer, who has paid advanced frieghts just as they were required, will have reached much earlier than in previous years the point of caring for only such ore as comes from the mines in daily output. He will therefore be prepared for high fall freights. The coal shipper, on the other hand, is so much behind in shipments that his hopes must rest with the much easier situation towards the close of the season than exists at present. If the general movement of freight keeps up, even on the present basis, coal frieghts must go to fancy figures and it will be impossible to move by lake the coal that will be required in the Northwest."

The Pittsburg Testing Laboratory, Ltd.—This firm of inspecting and metallurgical engineers and chemists has its main offices and laboratories at 325 Water st., Pittsburg. The Eastern office is at 18 South Broad st., Philadelphia, the Western office at 1750 Monadnock Block, Chicago, and the Southern office at 1112 E. Main st., Richmond, Va., with representatives at leading rolling mills and bridge shops throughout the country. The first organization was the Pittsburg Testing Laboratory, in 1883, then consisting of Wm. Kent, M E., Wm. F. Zimmerman, M. E., Alfred E. Hunt, M. E., and Geo. H. Clapp. In 1893, Mr. Zimmerman having retired, it was reorganized as a limited partnership. The business consists of the following lines: Inspecting and testing of the material and workmanship entering into the construction of all types of bridges, steel skeleton buildings; plates and shapes for steel vessels and barges, boilers, water pipe, stand pipes, etc.; the inspection of cast iron and steel riveted water pipe, valves, hydrants, etc.; locomotives, cars, axles, wheels and other rolling stock, rails and track fasteners. Another department includes evaporated tests of steam boilers, indicating of engines, duty and capacity tests of pumping engines, elevator, power tests, etc. In the firm's physical laboratories are made all forms of physical tests and special investigations. In especially equipped cement laboratories all classes of cement tests are made. There are complete chemical laboratories for all classes of analytical work. Particular attention is given to the analyses of water, filtration and purification processes. Consulting work is also done on the perfecting of all classes of manufacturing processes.

THE report of a consolidation of the chain manufacturers of the country appears to be based on an effort to bring some of the minor plants together. The previous effort included the Jones & Laughlins chain department, on which an option was secured, but it did not succeed and that plant is not now obtainable.

Pig Iron Production, First Half of 1899.

The American Iron and Steel Association has received from the manufacturers, and publishes in the *Bulletin* of Aug. 1 the complete statistics of production of pig iron in the United States in the first half of 1899, also statistics of stocks on hand and for sale July 1, 1899. As always, General Manager Swank leads the iron and steel statisticians of all countries in the promptness of publication and in completeness of returns The figures show that the total production of pig iron in the first half of 1899 was 6,289,167 gross tons, against 5,869,703 tons in the first half of 1898 and 5,904,231 tons in the second half. The increased production in the first half of 1899 over the second half of 1898 was 384,936 tons, or over 6 per cent. The production in the first half of 1899 was at the rate of considerably over a million tons a month. The production in these six months almost equaled that of the whole of the year 1894, which was 6,657,388 tons. But for the very severe weather of February and March, which seriously interfered with the activity of furnaces that were then in blast and with the blowing in of idle furnaces, the production of pig iron in the first half of 1899 would have been larger than it was. Allegheny county, Pa., made only a slight gain over the production in the second half of 1898, the record being 1,580,576 tons against 1,557,366 tons. The most noteworthy gains were by "miscellaneous bituminous" furnaces in Pennsylvania—those in the Western part of the state—which went from 264,925 tons in the second half of 1898 to 314,857 tons in the first half of this year; Mahoning Valley, which advanced from 356,269 tons to 447,044 tons; and Shenango valley, which increased to 428,727 tons from 343,312 tons. It is significant that Alabama furnace companies which have had every incentive to push production to the limit in the past six months, produced but 517,087 tons in that time, as against 521,828 tons in the second half of 1898 and 511,848 tons in the first half of last year. The production by States in the last three periods of six months is given in the table below:

TOTAL PRODUCTION OF PIG IRON.

States.	Blast Furnaces. In blast Dec. 31, '98	Blast Furnaces. June 30, 1899. In	Out	Total	Production. Gross tons of 2,240 lbs. (Includes spiegeleisen.) First half of 1898.	Second half of 1898.	First half of 1899.
Massachusetts	1	.....	3	3	1,243	2,418	978
Connecticut	1	2	3	5	3,426	2,910	4,390
New York	4	6	14	20	114,114	113,897	96,869
New Jersey	5	5	7	12	54,695	45,966	57,930
Pennsylvania	79	102	56	158	2,767,549	2,770,283	3,047,998
Maryland	2	2	6	8	108,684	85,290	101,715
Virginia	9	12	14	26	126,941	156,333	163,896
North Carolina	.....	1	1	2	.....	.....	3,397
Georgia	1	1	3	4	7,315	6,447	
Alabama	20	25	18	43	511,848	521,828	517,087
Texas	1	.....	4	4	1,817	3,361	3,643
West Virginia	3	3	.....	3	104,516	88,183	98,138
Kentucky	5	5	4	9	48,730	51,994	54,020
Tennessee	8	11	8	19	130,820	132,619	142,137
Ohio	34	36	19	55	998,951	987,407	1,075,033
Illinois	15	14	3	17	666,580	699 318	705,623
Michigan	6	6	7	13	74,848	72,792	65,117
Wisconsin	4	5	1	6	91,679	81,102	83,357
Minnesota	.....	.....	1	1	.....	.....	.....
Missouri	2	2	1	3	58,947	82,063	67,839
Colorado	2	2	1	3			
Oregon	.....	.....	1	1	.....	.....	.....
Total,	202	240	175	415	5,869,703	5,904,231	6,289,167

The figures of stocks on hand show some variation from the figures of the Western Pig Iron Association. This is explained in the statement that "the above statistics of stocks of unsold pig iron do not include pig iron sold and not removed from the furnace bank, or pig iron in second hands or in the hands of creditors, or pig iron manufactured by rolling mill owners for their own use." The rapid inroad on stocks is shown in the total of but 81,220 tons on June 30 against 291,233 tons on Dec. 31, 1898, and 571,577 tons on June 30, 1898.

Included in the stocks of unsold pig iron on hand on June 30, 1898, were 4,827 tons in the yards of the American Pig Iron Storage Warrant Co., which were yet under the control of the makers, the part in these yards not under their control amounting to 45,973 tons, which quantity, added to the 81,222 tons above mentioned, makes a total of 127,193 tons which were on the market at that date, against a similar total of 415,333 tons on Dec. 31, 1898. The total stocks in the above named warrant yards on June 30, 1899, amounted to 50,800 tons, against 150,800 tons on Dec. 31, 1898.

The distribution of stocks of unsold iron, separated according to fuel, is shown in the following tables:

STOCKS OF UNSOLD ANTHRACITE AND MIXED ANTHRACITE AND COKE PIG IRON.

States.	Gross tons of 2,240 lbs. Dec. 31, 1897.	June 30, 1898	Dec. 31, 1898.	June 30, 1899.
New York	20,548	20,303	18,341	9 977
New Jersey	7,710	10, 25	1,853	.....
Pennsylvania	78 623	93 020	63, 82	7,600
Tot l	106,901	123 848	83,976	17,527

STOCKS OF UNSOLD CHARCOAL PIG IRON.

New England	8,103	5,576	4,339	2,629
New York	8,147	6,819	6,664	1,700
Pennsylvania	7,466	7,212	7,392	6,560
Maryland	2,179	1,475	3,422	883
Va., Ga., and Texas	17,170	5,770	14,370	2 411
Alabama	17,591	15,393	7,347	6,372
Kentucky and Tennessee	15,410	13,888	14,558	4,638
Ohio	10 303	8, 82	4,899	1,268
Michigan	109,272	71,604	24,598	
Wisconsin	12,939	12,378	5,053	1,621
Missouri	5,028			
Pacific States	1,187			
Total	209,795	158,497	91,642	28,123

STOCKS OF UNSOLD BITUMINOUS COAL AND COKE PIG IRON.

New York	7,749	200	.....	992
Pennsylvania	122,771	96 367	37,631	4,972
Maryland and Virginia	69,489	75 105	18,412	5,032
Alabama, Georgia, and N. C.	44,070	53,277	20, 85	6,166
Kentucky and Tennessee	20,144	26,570	15,376	3,042
Ohio	65,935	54,172	24,011	10,091
Illinois, Wisconsin, and Minn	9,635	23 541	.....	4,476
Missouri and Colorado				
Total	339,793	289,232	115,615	35,571

The whole number of furnaces in blast on June 30, 1899, was 240, against 202 on December 31, 1898. The number out of blast on June 30, was 175, of which several have since been blown in and others are preparing to blow in. The production of coke iron in the half year was 5,478,655 tons; of anthracite iron, 682,027 tons; of charcoal iron, 128,485 tons, against 147,003 tons in the first half of 1898 and 149,747 tons in the second half. Production according to fuel in the first six months of this year and in the first and second halves of 1898, is shown in the following table, together with the unsold stocks of bituminous, anthracite and charcoal irons at the end of the last four periods of six months:

UNSOLD STOCKS AND PRODUCTION ACCORDING TO FUEL.

Fuel.	Stocks Unsold Gross tons of 2,240 lbs. Dec. 31, 1897.	June 30, 1898.	Dec. 31, 1898.	June 30, 1899.	Production. Gross tons of 2,240 lbs. (Includes spiegeleisen) First half of 1898.	Second half of 1898.	First half of 1899.
Bituminous	339,793	289,232	115,615	35,571	5,087,491	5,186,420	5,478,655
Anthracite	106,901	123,848	83,976	17,527	635,209	568,064	682,027
Charcoal	209,795	158,497	91,642	28,122	147,003	149,747	128,485
Total	656,489	571,577	291,233	81,220	5,869,703	5,904,231	6,289,167

The production of spiegeleisen and ferro-manganese in the first half of 1899 was 104,496 gross tons, against 109,641 tons in the first half of 1898 and 104,128 tons in the second half.

The production of basic pig iron in the first half of 1899, all made with coke or mixed anthracite coal and coke as fuel, was 465,957 gross tons, against 337,485 tons in the first half of 1898 and 447,959 tons in the second half:

PRODUCTION OF BASIC PIG IRON.

States—Gross tons.	1st half 1898.	2nd half 1898.	1st half 1899.
New Jersey	645	.....	.....
Pennsylvania—Allegheny county	153 420	224,727	230,109
Other counties	102 418	102,229	128,771
Maryland, Virginia and Alabama	55,834	98,995	82,377
Ohio, Illinois, Wisconsin and Missouri	25,759	22 008	24,700
Total	337,485	447,959	465,957

The production of Bessemer pig iron in the first half of 1899 was 3,788,907 gross tons, against 3,703,584 tons in the first half of 1898 and 3,633,800 tons in the second half. The pro-

duction of Bessemer iron by States and by Pennsylvania and Ohio districts is shown in the following tables:

PRODUCTION OF BESSEMER PIG IRON.

States.	Gross tons of 2,240 lbs includes spiegeleisen. 1st half 1898.	2nd half 1898.	1st half 1899.
Pennsylvania	2,953,774	1,987,191	2,113,418
Maryland	103,379	83,184	93,749
West Virginia	104,516	86,183	96,138
Ohio	799,937	770,598	787,971
Illinois	587,445	622,679	642,528
Michigan and Wisconsin	5,602	11,957	5,357
Missouri / Colorado	48,931	70,008	47,746
Total	3,703,584	3,633,800	3,788,907

PRODUCTION OF BESSEMER PIG IRON IN PENNSYLVANIA AND OHIO DISTRICTS.

Pennsylvania.	Lehigh Valley	38,434	36,686	15,308
	Schuylkill Valley	26,257	28,884	28,124
	Upper Susquehanna Valley	50,444	46,222	77,438
	Lower Susquehanna Valley	182,027	178,282	199,264
	Juniata Valley	.....	.....	.....
	Allegheny County	1,210,249	1,249,015	1,247,263
	Shenango Valley	368,815	256,410	351,203
	Miscellaneous bituminous	177,548	191,692	194,818
	Mahoning Valley and H. Rock bit	295,367	250,108	293,768
Ohio.	Hocking Valley	.....	.....	.....
	Lake Counties	173,833	188,915	166,704
	Miscellaneous bituminous	330,737	331,575	327,499

Trolley System in a Stove Foundry.

Writing in the *Tradesman*, of the latest line of foundry operations in which the trolley system has been employed with satisfactory results, E. H. Putnam says: "It is generally held to be impracticable to transport molten iron in a stove foundry otherwise than by hand. Fortunately this theory has at last been proven false, for the trolley system is in successful use in the Walker & Pratt Mfg. Co.'s foundry, at Watertown, Mass. The fact that the trolley or some other mechanical means for transporting the iron has not been commonly used in stove foundries is doubtless attributable to the fact that it is generally possible for the molders to carry by hand and pour all the iron that they can prepare molds for.

"True, a man will sometimes give out; his body will become so wrenched and strained under the arduous toil that he will have to cease from labor for a few days, to give nature a chance to restore the overwrought and torn muscular tissues; but this does not happen often enough to suggest mechanical transportation as an economical and profit-making measure. Stove molders used to carry 35 pounds of iron in the hand-ladles formerly used, but in some shops of the present time 50 pounds is the rule. The foundryman who has been a practical molder does not have to be told that to pour off a big day's work with 50-pound hand ladles, where the iron must be carried for any considerable distance, is the hardest kind of work. And it comes at the time of day when the average molder has already done twice as much work, at least, as the average common laborer performs in a day of ten hours.

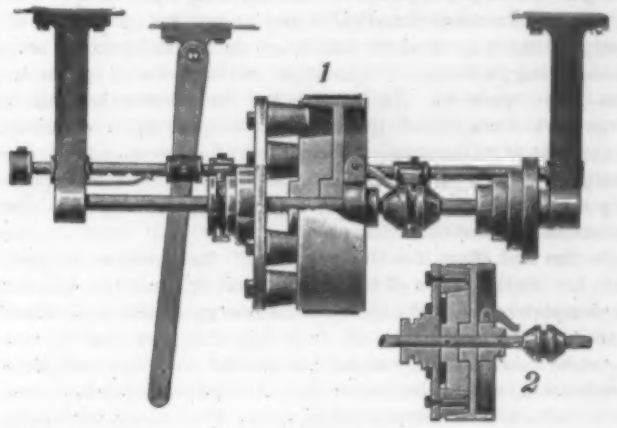
"The cost of installing a trolley is but slight, but the advantage to the workmen is very great. Humane foundry foremen frequently permit a molder to have the assistance of a laborer to carry the iron from the cupola to the distant floor in a double shank bull ladle, the laborer remaining and pouring the iron into the single-hand ladle, from which the molder pours it into the molds. But as laborers are very scarce in the foundry at the time of the heat, this is not generally practicable. But with a good overhead track, a large ladle, carrying many hundred pounds of iron can be managed by a single man, and it will serve a half dozen or more molders.

"There is no valid reason why this plan should not work with perfect success in a stove plate shop. There is but one plea that can be raised against it, namely: it may be objected that the iron under such circumstances may become too dull to run the work. This might indeed be quite true, in foundries where they don't know how to melt iron properly, but never in a foundry where the manager understands his business. It is well known that hard iron loses its 'life' much more quickly than soft iron; and in some foundries where iron high in combined carbon is used, or where semi-steel is made, they tap directly into the pouring ladles, and every body goes with a rush, in order to get the metal out of the ladles before it freezes. But the foundryman who understands the manipulation of the cupola, will tap into a large cupola ladle, and will pour from that into the smaller ladles; and these small ladles will come back to the cupola as clean as when they went away. If this can be done in the case of semi-steel, how much more easily it can be done with stove-plate iron, which is the very softest kind of iron, and will therefore remain fluid much longer than any other."

REVERSING MECHANISM FOR MACHINE TOOLS.

The mechanism shown in the accompanying cuts was patented recently by E. E. Norton, of Bridgeport, Conn. Figs. 1 and 2 show the essential features of the device, which is designed to take the place of the open and crossed belt arrangement generally used on lathes and other tools for reversal of movement. Fig. 1 is a view of the reversing mechanism with parts in section; Fig. 2 is a section showing the operative parts in a different position.

Upon the lower shaft a disk is rigidly secured, which is provided with a conical periphery. Loosely mounted on the shaft is a pulley having an interior conical flange. By means of a clutch of any desired form, the pulley can be locked to the shaft, so that the motion of the pulley is communicated to the shaft. A second disk loosely supported on the shaft is



provided with a series of rollers in a circle which can be shifted into engagement with the periphery of the first mentioned disk and the internal surface of the conical flange of the belt pulley. The clutch and the roller disk are so connected by a movable rod that they may be simultaneously operated by a shifting lever.

When it is desired to turn the shaft and the belt pulley in one direction, the shifting lever is swung to the left, thus causing the clutch to bind the pulley to the shaft. When it is desired to reverse the motion of the shaft, the operator, by means of the lever, shifts the movable rod to the right, and thus changes the positions of the clutch and roller disk from those shown in Fig. 1 to those shown in Fig. 2. The clutch is thereby made to disconnect the pulley from the shaft; and the roller disk is reciprocated so as to throw the rollers into engagement with the pulley flange and the first metioned disk.

Pig iron shipments from Alabama and Tennessee for the first six months of the year were 757,796 tons, an increase over the same period last year of 137,698 tons, or 22 per cent. Total movement of pig iron from the Birmingham district alone, 451,019 tons, an increase over same period last year of 68.031, or 18 per cent. Total movement of cast iron pipe from Alabamaand Tennessee foundries, 83,115 tons, an increase over the same period last year of 19.326, tons, or 27 per cent. Total movement of cast iron pipe from the Birmingham district alone, 31,422 tons, an increase over the same period last year of 7,653 tons, or 30 per cent. Total movement of export iron from the Alabama and Tennessee field, of which the Birmingham district furnished nine-tenths, 98,142 tons, an increase over the same period last year of 38,855 tons. Total amount of cast iron pipe exported from the Alabama and Tennessee field, of which the Birmingham district furnished nine-tenths, 7,942 tons.

A FORMAL order was made in court last week dissolving the Oliver Wire Co., the Pittsburg Wire Co. and the Allegheny Furnace Co., which were absorbed by the American Steel & Wire Co.

HEAT LOSSES IN A STEAM BOILER.

BY W. F. DURAND.
[Principal of School of Marine Construction, Cornell University.]

The purpose of the steam boiler is two-fold. In the furnace the energy of the coal is to be liberated through the process of combustion. This being accomplished, the energy is present in the hot furnace gases, and if we were using a direct combustion engine, such as the gas or gasoline engines of various types, we should use this gas direct, and ask nothing of an intermediate substance. In the steam engine, however, we do not use the hot gas direct, but for purposes of convenience prefer the intermediate substance, steam. We must never forget that after all it is energy that we are dealing with, and that if we use steam it is only as an intermediate substance, only a carrier of the energy from the hot gas to the engine, only a convenient substance by means of which we may transform this energy into mechanical work in a steam engine. If then the steam is to carry the energy from the hot gas to the engine, it must first receive it from the gas, and in this operation we find the second of the two purposes of the boiler.

The first purpose is to liberate the energy, the second to transfer it over into the water, thus forming the steam. Now it is one of the most remarkable and important properties of energy, that in general we can never do anything in the way of changing its form or its location without losing more or less in the operation. In fact it is not too much to say that a large part of the life of the engineer is spent in endeavoring to prevent or to decrease these various losses to which the energy which he handles is so continually subject. Especially is this true about a steam boiler. Let us examine the nature of some of these losses.

In the first place it is the purpose of the furnace to provide for the liberation of the energy, and this purpose will not be completely fulfilled unless all the energy available is liberated in the form of heat. If it is not thus set free it can never be used. This complete liberation requires complete combustion, and to the extent that the combustion is not complete there will be corresponding loss. The combustion may be incomplete in a variety of ways. A part of the coal may shake or fall through into the ashpit and also escape the fire. Some of the finer peices, especially with soft coal, may be carried along with the draft into the tubes or front connections and so escape combustion. Then again smoke is a sign of incomplete combustion. Smoke itself is composed of very fine particles of carbon formed from the hydro-carbon gases which are given off by the coal. If these gases do not find the conditions proper for their complete combustion, they give rise to smoke. So far as amount goes, the loss through the smoke itself is far less than might be supposed from its appearance, and if there were no other reason than economic loss, it is hardly likely that smoke prevention would be an important object, or would be worth the investment of very much capital. In a general way, however, the presence of smoke implies the absence of the conditions for perfect combustion, and there may be more loss than that which appears merely as smoke. It follows that smokeless combustion, especially with bituminous or semi-bituminous coal, is usually considered as implying an efficient or complete combustion, at least so far as hydro-carbon gases are concerned.

In general, the conditions necessary for complete combustion require not only a current of air with its oxygen traversing the bed of coal on the grate, but also a proper supply of air beyond the grate in the furnace or combustion chamber for the combustion of these gases. There must also be a sufficient temperature for this combustion, else they will mix and pass off without burning. High temperature and proper air supply are therefore the two things needed; the one is quite as important as the other, and neither is sufficient in itself.

A further and important loss may also result from another form of incomplete combustion. It so happens that carbon, the chief constituent of coal, may enter into chemical combination with oxygen, in two ways. That is, there are two kinds of combustion for carbon. In one of them the resulting gas is called carbon monoxide, and in the other carbon dioxide. In the latter there is twice as much oxygen per pound of carbon as in the former. The combustion in this case is complete, and all the heat available is liberated amounting to 14,500 heat units per pound of carbon. In the production of carbon monoxide, however, the combustion is not complete, and only about 4,450 heat units per pound of carbon are liberated. If, however, this gas meets later with the proper conditions, carbon dioxide is formed and the remaining heat is liberated. If the conditions are not met with, the carbon monoxide will escape unchanged, and carrying away with it over two-thirds of the available heat. The conditions necessary for the combustion of the carbon monoxide are a sufficient temperature and a supply of oxygen above the grate. The necessary temperature is usually insured by an active condition of the fire, and the oxygen is provided by inlets for air through the fire door or above the grate. This gas, carbon monoxide, is especially found when using hard coal soon after firing a fresh charge. With proper air supply it burns with the blue flame so commonly seen at such times. In fact the presence of this flame may be taken as evidence of the formation and combustion of carbon monoxide, but whether all that is formed is burned cannot be known without an analysis of the waste gases.

These are the more important opportunities of loss by incomplete combustion. How much will they amount to in any given case? That of course depends, but with care it is quite certain that they can be reduced to a very small amount, while without it they may rise to a considerable fraction of the coal thrown on the fire. It is rare that they can be reduced to less than one or two per cent, and it is quite certain that they often reach values of five per cent or over, while with careless firing and poor conditions they may rise to 20 or 30 per cent or more. Other things being equal, these losses usually increase with an increase in the draft pressure and amount of coal burned per square foot of grate surface. Their reduction means a boiler plant properly designed for the duty required, and firemen who know their business and are alive to the need of a constant watch on all the conditions of the combustion.

We must not pursue this part of the subject further, but pass on to the next great source, a loss in the boiler. The energy has been liberated from the coal and is in the hot gas. It must now be transferred to the water. The pathway between the two is the heating surface, but unfortunately, try as we may, we cannot induce all of the heat to go that way. Instead a very considerable part declines our invitation to transfer, and remains with the gas, passing with it out to the open air where it is lost beyond recovery. The causes of this loss are as simple as they are difficult to overcome. In the first place we cannot get all the developed heat out of the gas and into the water without cooling down the gas to the temperature of the outside air. But this is far lower in temperature than the water in the boiler. Now it is one of the properties of heat that, unaided, it will never flow from a cooler to a warmer body, but always from a warmer to a cooler. Hence we could never expect, under any circumstances, to cool the gases down below the temperature of the water in the boiler. If the steam pressure carried is 125 pounds, for example, this will be about 352 degrees. All of the heat between this temperature and that of the air, say about 70 degrees, is therefore sure to escape with the gases simply because it cannot be induced to flow from gas into water or steam at a higher temperature than the gas itself. To cool the gases down to the temperature of the water is therefore the very best that could be expected under the most ideally perfect conditions. Actually we cannot do nearly as well as this. To reduce the temperature of the gases down nearly to that of the water and steam would require an enormous amount of heating surface in the boiler; far more than could be afforded. As the difference in temperature between the water and hot gas decreases, the less will each square foot of heating surface transfer. Hence as the gases pass along the heating surface each square foot of area transfers a less and less amount, and vice versa to transfer a given amount requires more and more area. It thus follows that the area needed to reduce the temperature of the gases one degree will become larger and larger as the temperature becomes lower and nearer that of the water, and hence to reduce them very near to that of the water would require an excessive amount of surface. This would mean a large investment in boiler heating surface for a very little saving in heat, and there soon comes a point where such an investment ceases to be a profitable one.

But there is still another reason why we do not try to re-

duce too far the temperature of the escaping gases. This is the question of draft, or more especially, natural or chimney draft. This is a large subject in itself, but it will be sufficient for present purposes to note that natural draft depends on the formation of a column of hot gas in the chimney, and that the draft pressure is the difference in the weight of a column of gas of sectional area equal to one square inch and of a height equal to that of the stack, and of the weight of a like column of air of the same height. Now the hotter the gas the lighter, and hence the greater the difference, and the greater the draft pressure. Hence for good draft we need a column of fairly hot gas in the stack, and practically it is found hardly desirable to attempt to deliver the gases below 600 degrees to 700 degrees. This means that all the heat in the gases between this temperature and say 70 degrees escapes with them and is lost. How much will this be? Usually from 20 to 30 per cent, and though in wasteful circumstances it may be much more, we can hardly hope to make it much less. This loss, in general, increases with increase in the rate of combustion. It is also large when the amount of heating surface is relatively small, or not efficient in action. The latter condition may be due to coating on either or both sides; scale, or oil and scale on the water side, and soot on the fire side. These coatings by opposing extra resistance to the passage of heat decrease the amount transferred and so increase the loss. With a given heating surface the most efficient action requires that it shall be clean and in good condition on both fire and water sides.

In addition to this loss of heat with the escaping gases there are several other sources of loss of which mention may be made. There is a certain amount of heat lost by direct radiation from the furnace and from the exterior of the boiler. A small amount is also lost with the ashes which are withdrawn from the ashpit from time to time. Blowing off the boiler to remove mud, oil and scale is also a source of loss greater or less according to the extent to which this is necessary for the proper operation of the boiler. The amount of these latter losses is usually small, though their existence and possible importance should not be forgotten.

The total amount of these losses will be rarley less than 25 per cent, though reports of losses not exceeding 20 per cent are to be found. From 25 to 35 per cent are common values, while under poor conditions they may rise to 50 per cent or even more. The remaining fraction is known as the boiler efficiency and is accordingly found usually between 65 and 75 per cent.

It will be observed that these various losses depend in part on the type, design, and proportions of the boiler, and in part on its operation. Now, in closing, we wish to call attention to the fact that for the best financial return on an investment in boilers, it does not necessarily follow that these losses, either as dependent on type and proportion or on operation, should be the smallest possible. One of the most interesting developments in engineering science during the past few years has been the clearer recognition of the fact that the engineering problem must not be separated from the economical or financial situation. Engineers have been sometimes given to think that the sole end and aim of their life was to handle enegry in the most economical way possible, viewed purely from the energy standpoint. But in reality the engineer is but a link in the vast industrial army, which is engaged in making dividends on invested capital, and the more correct view is, that it is his duty to provide the largest output in useful product for a given total expense in money or its equivalent. When this view is accepted many interesting results follow, one or two of which may be illustrated by the steam boiler.

Thus from the engineering standpoint the most efficient boiler is the best; but from the wider standpoint this is not necessarily the case. The total expense in a boiler plant may be for our purpose classified under two heads. (1) The interest account, including interest, insurance, taxes, depreciation, and some repairs. (2) The operation account, including fuel, wages and general supplies. Now in a general way the more efficient the boiler, the more expensive. Large heating surface and various extra attachments for increasing the efficiency all cost money, while vice versa the cheaper boiler may naturally be one of lower efficiency. Now it is readily seen where coal may be had at a low figure, that it may be cheaper to buy coal than boiler, and that the total expense may be made less by using a cheap boiler and more coal, rather than a little less coal with a considerably larger interest account on the boilers. On the other hand where coal is high, the more expensive boiler, provided there is a corresponding gain in efficiency, will always prove the cheaper in the long run.

Similarly as to mode of operation. A small boiler may be crowded to a high rate of combustion, and will give a certain amount of steam, probably with low heat efficiency. On the other hand a large boiler may be run so as to provide the same amount of steam with much better efficiency. The small boiler will require more coal but will have a smaller interest account. Which will prove the better for the investor will depend on the actual figures; on the price of coal, the rate of interest, etc. With very cheap coal, however, it may easily result that the small boiler will be the better investment; while as coal is higher the more is it necessary to pay attention to coal economy, and the more expensive but more efficient boiler will prove the better for the investor.

In general the higher the operating expenses, more particularly as regards coal, the more efficient should the boiler be, both in proportion and in mode of operation, in order to give the best return on the investment. In all such cases the right point is found just where the added interest account on the investment needed to effect a saving in operating expenses, will just balance the saving so effected. It would also be found that the proper solution in any given case would depend on how long per day the boiler were run; whether 8, 10, 12 or 24 hours. In general the more hours the boiler is operated per day or per year, the larger is the coal account in comparison with the interest account, and the more efficient should the boiler be for the best financial result. It must be noted that these considerations justify an increase only in those losses which are a necessary and direct consequence of an increase in useful output, and then only when the increase in output more than offsets the increased loss in efficiency. Space forbids a more detailed examination of these questions, for while the principles involved are simple, they need special application to each individual case. In general it is doubtless true that boilers are commonly operated at too low rather than too high an efficiency, and in any event the engineer can make no mistake in reducing to the lowest possible amount all losses which are not the direct and necessary consequence of an increase in the output, while for such as are thus related to output, judgment must be used in the light of the principles above considered.—[The Boiler Maker.

Tin Plate Workers Well Paid.

Referring to some of the newspaper statements that convey the impression that the tin plate works employes were not well paid before the recent 15 per cent advance, *Tin and Terne* says: "The real facts in the case are readily proved by a reference to the printed scale book of the Amalgamated Association for the year which expired June 30, and easily accessible statistics as to the number of mills operated under Amalgamated auspices. The company has 272 mills usually in operation, 27 of which are not run with Amalgamated members, leaving 245 mills which are so operated; and this, with 13 men to the mill, gives 3,185 men as the total number of men whose wages are affected by wage agreements between the American Tin Plate Co. and the Amalgamated Association. The total wages for these men on the most common gauge is $10.61 a ton, and the output per day (three turns) averages 7½ tons, and there is thus $79.56 a day to be distributed among 13 men, which gives an average of $6.12 a day to each man, some making considerably more and some considerably less than the average. These are certainly more than living wages, without any advance."

EXPERT accountants have been in Cleveland the past week in connection with the inventory of plants of the Shelby Steel Tube Co. This is reported to be preliminary to the formation of a greater seamless steel tube consolidation which shall include in addition to the Shelby, Toledo, Ellwood and Greenville plants of the Shelby Steel Tube Co., that of the Pope Tube Co. at Hartford, Conn., and a plant at Albany, N. Y.

GEAR CUTTING MACHINE.

The latest style of automatic gear cutter manufactured by F. H. Bultman & Co., Cleveland, represents a remodeling of the machine, and the embodying of a number of improvements. The No. 1, or 36-inch machine, for spur, bevel and worm gears, will carry the full limit of any gear cutter of Brown & Sharp make up to two diametral or one and one-half inch circular pitch of five inches diameter, and may be regulated to suit any pitch or material. A special feature of the machine is the patent safety device, which insures against spoiled blanks. It is positive in operation, the cutter being prevented from entering the work unless it is properly spaced.

The provision for the inspection of the blank being cut, without dropping out the worm from contact with the dividing worm gear is a valuable feature. Fig. 2, which is reproduced from *Machinery*, shows the dividing wheel W loose on the workshaft but held securely in place by the dowel pin P. When it is desired to inspect the work, the dowel pin is driven out by a light tap of the hammer and the gear blank G can then be revolved by hand without disturbing the contact of the worm and the worm dividing the wheel, upon the accuracy of which depends the accuracy of the gear to be cut. After having inspected his work the operator has only to turn his blank back until the cutter comes about into line with the last cut, when the insertion of the dowel pin will bring the wheel accurately to its position. This feature is clearly shown in the side and rear views of Fig. 2. The dividing wheel is brought to the highest perfection. The steel worm which operates it has a compensating device maintaining the original accuracy, which is never disturbed.

The depth of the tooth is controlled by the elevating screw to raise and lower the knee. The screw carries a dial graduated to the one-thousandth of an inch, enabling the operator to get the exact depth without lines or depth gauge. One of the quadrats and the front of the swivel carriage are graduated to degrees, and can be set any angle necessary for bevel or worm gear cutting. The feed-screw is driven by a worm and worm-wheel, giving a powerful and steady motion. It is fitted with bronze feed nut and bronze thrust-bearing, with compensating adjustment to take up wear, and, being directly under the center of the cutter, there is no side strain.

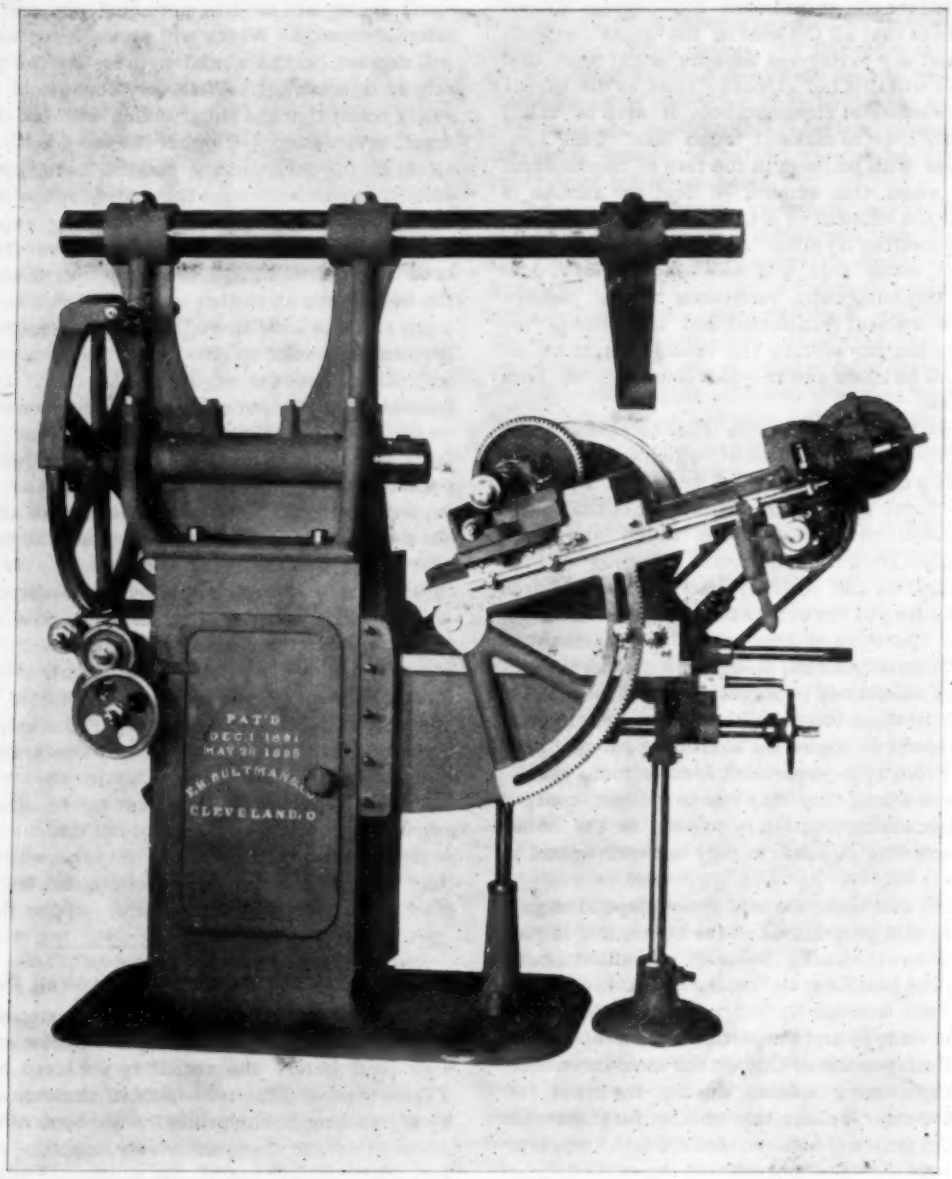


FIG. 1.—GEAR CUTTING MACHINE.

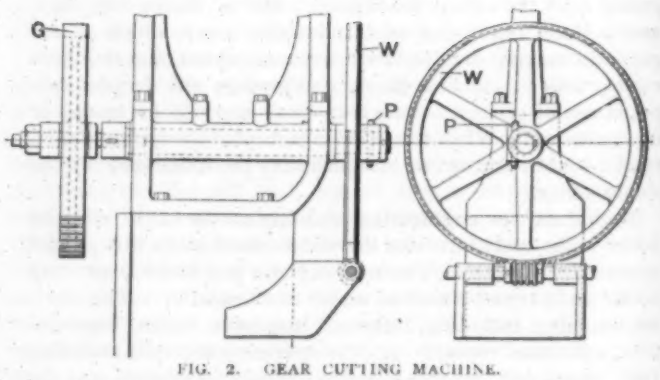


FIG. 2. GEAR CUTTING MACHINE.

There are eight changes of feed best adapted for the rapid production of work, the feed ranging from one to seven inches per minute, according to the size of the pitch or nature of the material. The mechanism for feed and return of carriage is patented.

IN THE INDIANA GAS BELT.

The Lambert Gas and Gasoline Engine Co. is located at Anderson Ind. It engines have been on the market for the past eight years and are in use all over the United States and Canada. Tney are adapted to a variety of situations, ranging in size from two to 50 h. p. For irrigating, mining and farming purposes they have gained a good reputation, and are found desirable in connection with moderate sized electric lighting plants. The present capacity of the works is about three completed engines per day and 75 men are steadily employed. Of the claims made for the Lambert engine, the chief are simplicity of construction and decided economy as to cost of power. The estimated cost shown by the company for a 20 h. p. gasoline engine running under full load for 10 hours is $2.30, or about 50 per cent cheaper than steam. Where coal is not easily available this class of engine has found special favor, and where coal is plentiful, the relative cost of operation is still an important consideration. The company reports a successful year with prospects better than ever.

The Wright Shovel Co., of Anderson, Ind., is operating their works under full capacity and employing about 200 men at present. The business has been established in Anderson since 1891, but originated two years earlier at Beaver Falls, Pa. The company manufactures shovels, scoops and spades, and ships the product all over the world.

The Arcade File Works, of Anderson, Ind., are constantly building and increasing their capacity and will soon be in shape to turn out 3,000 dozen files per day. At present over 500 hands are employed and the product is shipped all over the civilized world They also manufacture bicycles.

The Barber Mfg. Co., of Anderson, Ind., reports an increase of about 50 per cent over last year's business and at present employs 20 people. The business has been in operation four years and is confined exclusively to high class spiral bed springs, known as the "lace web." The company has an extensive trade through Indiana, Illinois and the Central West generally.

The Northwestern Scraper Co., of Anderson, Ind., is about to construct a new building 60x200 feet, and new forging department in addition to the present works. It will enlarge its field on bridge work, which together with the force employed now on building road scrapers, will furnish employment to about 150 men.

The Anderson Forging Co., Anderson, Ind., reports a steady increase in business and now employs 65 men. The company is an extensive manufacturer of buggy hardware, and has lately added a department for the manufacture of bow sockets for buggy tops. The trade is mostly through Michigan, Ohio, Indiana, and Wisconsin, although some goods are sold at more remote points.

Union Steel Casting Co.

A very remarkable record was made by the Union Steel Casting Co., Pittsburg, in the erection of its plant at 61st st., and A. V. Ry., Pittsburg. Ground was broken for the foundations April 25, last, and molding was commenced July 5, the first heat being made July 10, it being thus 71 days until molding was begun and 76 days until the first heat was made. A great deal of excavating was required to level the ground, and of this excavating 2,000 cubic yards was removed in the 10 days before work on the foundations was begun, 10,000 yards more being removed after that date. The speed in completing the plant was due largely to the specially good work done by the Schiffler Bridge Co., in the erection of the building, which is of steel construction, 124x240 feet, covered with corrugated iron. In one corner is a 50 h. p. Westinghouse gas engine, and another 50 h. p. is to be added. The 15-ton acid open-hearth furnace was built in the most satisfactory manner by Alex. Laughlin & Co, Pittsburg, and is located at the middle of the side opposite the power department. The building is served in its entire length by two three-motor electric traveling cranes, one by the Morgan Engineering Co., of 20 tons capacity, and one by Pawling & Harnishfeger of 10 tons capacity. It is intended to add a third crane. Casting can be made up to 25,000 or 30,000 pounds in weight.

The arrangement of the plant is very satisfactory and the work is accomplished with a minimum of difficulty. The molding is done in the east end of the building, the molds being carried by the lighter crane to the middle of the building, in front of the steel furnace, where they are poured. They are then dumped and the castings carried to the western end of the building by the larger crane, where whatever finishing is necessary is done. A railroad track runs into this end of the building for rail shipments, and a branch from this main switch runs along the north side of the building outside, to the steel furnace for the delivery of fuel and iron. In order to start the furnace gradually, 10-ton heats were made on the 10th, 12th and 4th of the month. After this date the heats were made daily and of increasing size, until this week when two full 15-ton heats have been made daily. The castings have all been very successful, and no steel or castings have been lost, the whole plant running as smoothly as one long in operation. The plant is modern in every particular.

The Union Steel Casting Co. is incorporated under the laws of Pennsylvania, with $70,000 capital stock, which may be increased shortly, as a number of improvements are contemplated. Chas. Marshall, of the Schiffler Bridge Co., is president, and Uriah Tinker, of Samuel Trethewey & Co., Ltd., is treasurer. These gentlemen do not take an active part in the management of the business, which is largely in the hands of C. C. Smith, secretary and manager, formerly of the Reliance Steel Casting Co. Howard I. Fisher is superintendent of the plant.

Iron and Steel Institute.

The autumn meeting of the Iron and Steel Institute will be held at Manchester, Eng., Aug. 15, 16, 17 and 18. The following papers are to be presented.

"The Constitution of Steel," by Prof. E. D. Campbell, Ann Arbor, Mich.

"Diffusion in Steel," by F. W. Harbord, and Thomas Twynam.

"The Magnetic Concentration of Iron Ore," by H. C. McNeill.

"India as a Center of Steel Manufacture," by Major R. H. Mahon.

"Pig Iron Fractures and Their Value in Foundry Practice," by J. W. Miller, of the Uehling Co., Ltd., London.

"Practical Microscopic Analysis for use in the Steel Industries," by C. H. Ridsdale.

"The Relation Between the Structure of Steel in its Thermal and Mechanical Treatment," by Albert Sauveur, Boston, Mass.

"The Present System of the Solution Theory of Carburized Iron," by A. Stansfield.

"The Iron Industry in the Territory of His Highness the Nizam," by Shamsul Ulama Syed Ali Bilgrami, of the Nizam's government public works department, railways and mines.

"A New Casting Machine for Blast Furnaces," by R. Hanbury Wainford, Stoke-upon-Trent.

"The Utilization of Powdered Iron Ore," by Prof. J. Wiborgh, Stockholm.

THE greatest record in the history of the region was made by Connellsville coke companies for the week ending July 15—an estimated production of 190,792 tons, as compared with 173,322 tons in the week preceding. The shipments were 10,238 cars, an increase of 1,499 cars. Shipments, like production, were record-breaking.

THE Société Anonyme de Marcinelle et Couillet, of Couillet, Belgium, recently advertised in the United States for 5,000 tons of Thomas pig iron. Belgium annually imports about 300,000 tons of pig iron. Its production in 1898 was 979,101 metric tons and in 1897 1,034,732 tons.

THE production of pig iron by the Fannie Furnace, at West Middlesex, Pa., has been contracted for by the American Steel Hoop Co. for one year. The furnace was blown in on May 27 after an idleness of several years. It is owned by the Reed Furnace Co., and has an annual capacity of 36,000 gross tons.

THE Indianapolis Foundry Co. is running at full capacity and doing a business that averages 25 per cent more than last year. At present the company employs about 300 men, 200 of them being molders.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

"R. E. O. W." care *The Iron Trade Review*, well-known manufacturers, advertise elsewhere for $50,000 worth of new and second hand tools for machine shop and foundry.

A 10x12 or 14-inch left-hand side-crank stationary engine, self-contained, second-hand, is wanted. Address P. O. Box 284, Richmond, Va.

D. W. Alderman & Sons Co., Alcolu, S. C., wants to buy 100 to 200 tons of 30-pound steel relaying rails.

A charter has been granted to the Westbrooks Foundry & Machine Co., Danville, Va., to manufacture iron and wood-working machinery.

A charter has been granted the Chattanooga Furnace Co., Chattanooga, Tenn, with $100,000 capital stock. The incorporators are J. R. Rice, C. E. James, Levi Wade, S. B. Stewart, and D. F. Beckhard. The old Chattanooga furnace will be repaired.

New Construction:—

Estimates have been made for a new machine shop for Geo. V. Cresson, Philadelphia. It is to be 40x112 feet and to cost $12,000.

The Standard Boiler Co., Goshen, Ind., is to remove to Harvey, Ill. A building 60x80 feet is being erected.

A machine shop will be built at Hurley, Wis., by E Charbonneau and others.

The Oil Well & Supply Co., of Pittsburg, is planning to erect a boiler plant 50x200 feet at Oswego, N. Y., citizens furnishing the site. J. J. Tonkin, consulting engineer, of the Pittsburg company, is patentee of the Tonkin boiler.

The Olds Gasoline Engine Works, Lansing, Mich., are building a large works at Detroit with 2½ acres of floor space and will operate the Detroit and Lansing plants to their full capacity.

The Dunbar Furnace Co., Dunbar, Pa., will rebuild its furnace No. 1 and increase its capacity considerably.

At Reading, Pa., plans have been drawn for proposed new shops for the Reading Railway Co. The improvement is to cost $500,000 The main structure of the new plant will be 300x700 feet, and there will be a number of smaller buildings. The present locomotive shop will likely be leased for manufacturing purposes.

The Waukesha (Wis.), Malleable Iron Works have broken ground for an addition to their plant. The company is about to construct a foundry and other buildings, which will be 70 x250 feet and will increase the working force to 300 men. This will about double the capacity of the plant.

The Stover Mfg. Co., Freeport, Ill., has decided to erect a large plant for the manufacture of its line of implements, consisting of wind mills, grinding mills, etc, and will begin operations soon, to have it ready for use by the first of the year. The company will utilize its present plant for the hardware part of its business and will give employment to a large number of men. The two buildings to be erected will be of a substantial character and composed largely of stone, brick and steel, chiefly one story high. The plant will cover about five acres to start with and will be constructed on plans that will admit of expansion. Some of its lines the company has been obliged to buy outside for the want of sufficient factory room.

Power Equipment and Machine Tools:—

The Harrisburg Foundry & Machine Co. Harrisburg, Pa., has received an order for a large engine for an electric plant to be built in Sweden. The engine will be direct connected to a generator, according to the maker's latest designs.

The Mesta Machine Co., of Pittsburg, has secured through its Western agents, Edward M. Hagar & Co., the Rookery, Chicago, an order from the Illinois Steel Co., for five immense blowing engines of the horizontal cross-compound type. The engines have steam cylinders 44 inches and 84 inches in diameter, each having two air tubes 84 inches, the stroke of all cylinders 66 inches. Each engine will weigh 400 tons. They will be used to furnish blast for two new furnaces of the Illinois Steel Co., being erected at South Chicago.

The Janesville (Wis) Machine Co., at its annual meeting July 18, elected directors as follows: A. P. Lovejoy, Hiram Merrill, David Jeffris, John G Rexford, James Harris, S C. Cobb, A. M. Valentine J. A. Craig. The following officers were elected: President, A. P. Lovejoy; vice-president, Hiram Merrill: treasurer, John G. Rexford; secretary, S. M. Smith; superintendent, S. C. Cobb; general manager, J. A. Craig. A semi-annual dividend of 3 per cent was declared.

The Pittsburg District:—

The Pittsburg parties who recently incorporated the United States Motor Co., have secured a Delaware charter for the Pennsylvania Liquid Air Co., it being intended to use liquid air for motive power in vehicles.

The W. Dewees Wood Co., McKeesport, Pa., has granted a 10 per cent increase to the 300 men in the knobbling department.

A press dispatch from Findlay, O., states that David B. Oliver and Daniel Wenke, oil producer, both of Pittsburg, are making a thorough examination of the old Columbia glass factory and the Kellogg Weldless Tube Works, at Findlay, and it is expected that a bid will be made at the public auction sale of the latter plant next month.

The Pennsylvania Casting & Machine Co., is erecting a plant adjoining the Pennsylvania Car Wheel Co., in Allegheny. The same parties are interested in both plants. The plant being erected will make a specialty in gray iron castings. Joshua W. Rhodes is president, J. B Rhodes, vice-president, W. L. Elkins, treasurer, and J. M. Tate, secretary.

W. J. Carlin has recently opened offices at 610 and 611 Lewis Block, Pittsburg, in order to carry on to better advantage his business of dealing in second hand machinery and complete plants. Mr. Carlin has been engaged in this line for a long time, and has purchased and wrecked or otherwise disposed of a great many iron and steel and other plants. Among those recently purchased may be mentioned the Linden Steel Works, Pittsburg, and the Premier Steel Works, Indianapolis, Ind. With the latter works Mr. Carlin purchased the ground also, and may start the plant in operation and sell it as a going business.

A report has been published that Jones & Laughlins, Ltd., Pittsburg, were completing a rod mill. This is incorrect, and the story probably refers to one of the two new continuous bar mills which are now nearly completed in the plant. The cold rolled shafting department is being enlarged and fitted with the latest machinery, designed largely in the firm's own drafting department.

James Bonar & Co., Carnegie Bldg., Pittsburg, report the following July sales on Sweet's steam separators: Penn Coal & Iron Co., Canal Dover, O., one 10-inch; P. Duff & Sons, Pittsburg, Pa., one 4-inch; Pittsburg Steel Foundry, Glassport, Pa., two 6-inch; Atwood & McCaffrey, for Lebanon Furnaces, one 8-inch; J. H. Nicholson, Ellwood City, Pa., one 8-inch and two 6-inch; Salumn & Ruben, Pittsburg, Pa., one 2½-inch and two 4-inch; Ernst R. Behrend, Erie, Pa., one 4-inch; Atwood & McCaffrey, for Alabama Steel & Ship Building Co., Birmingham, Ala., two 4-inch, two 2-inch, and two 3-inch. JamesBonar & Co. are also busy on all their other specialties.

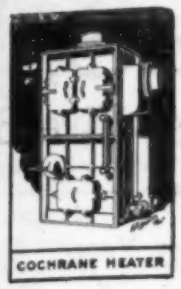
General Industrial Notes:—

When the Champion Iron & Steel Co., of Chicago, started up the Muskegon, Mich., rolling mill three months ago, the plant was put in at $150,000, and stock issued for it. David M Hillis, a Chicago attorney, secured a deed to the property, which he in turn deeded to the new company and claimed the stock. John E. Jones, also of Chicago, filed a bill of chancery claiming that by virtue of a contract existing between him and Hillis he was to have a half interest in the property and proceeds, and he asked for an injunction to restrain the Champion Iron & Steel Co. from issuing the stock to Hillis. The matter is now being litigated.

The Heilman Machine Works, at Evansville, Ind., are to be sold under court orders Sept. 15, or between that date and Nov. 1, at private sale. The stockholders have until Sept. 15 to take in the property. The indebtness is about $81,000.

The Ironsides Co., of Columbus, O., which among other

What Becomes of the Heat in Steam?



Generally less than 10% is utilized in doing work in the case of a non condensing engine. Over 80% of all the heat that was put into the steam originally is washed away through the condensing water in the case of a condensing engine.

Is there not some way of utilizing this waste product? Yes; there are severel ways, nearly all of which depend upon a **Cochrane Heater** for accomplishing the greatest possible saving, and the greatest improvement in the quality of a boiler feed supply.

We shall be glad to have the opportunity of explaining to you how, within certain limits, a **Cochrane Heater** can get more heat value out of steam than the best engine ever built—why they are made in their present form, and of certain particular metals—and, in general, why they are better than other appliances for a similar purpose It is a fact that they are better.

HARRISON SAFETY BOILER WORKS,

Clearfield & Seventeenth Streets, PHILADELPHIA, PA.

lines of lubricants, manufactures special materials for lubrication of wire ropes and gearing, states that its business is in excellent condition. These materials, by formation of deposits on the exposed and wearing surfaces, resist water and acid attacks and retards wear. Endorsements have come from a wide range of users extending to all general mining and industrial lines, including heaviest rolling mill work.

Reade & Bowler, of Cleveland, have purchased the entire equipment of machinery and tools of the following plants: Chapin Bolt & Nut Co., Cleveland, which consists of about 50 bolt and nut machines; the Maumee Cycle Co., Toledo, O., and the Findlay Rolling Mill Co., Findlay, O. They have sold the entire outfit of the Findlay mill to investors who will probably operate it.

A number of Alabama furnaces will be added to the active list in the second half of the year. The Alabama Coal, Iron & Railroad Co. has let a contract for the repair of its furnaces at Gadsden and Ironton. The Tennessee company is adding a fifth stack, 75x18 feet at Ensley. Vanderbilt furnace at Birmingham is nearly ready. Philadelphia furnace at Florence will be blown in this fall. One Alice furnace has been repaired after long inactivity and is now making iron. Jenifer has been changed from charcoal to coke and will go in again. Talladega furnace will soon be in blast and Trussville furnace will probably blow in in the fall. The Brierfield furnace is also to be repaired.

At Pottsville, Pa., July 15, the real estate, personal property and franchises of the Pottsville Iron & Steel Co. were sold by the receiver, to H. P. Brown, representing Philadelphia holders of receivers' certificates, for $27,800. Certain creditors will contest.

The articles incorporating the $20,000,000 Buffalo steel company are expected to be filed in September. Engineers are engaged upon preliminary work.

The deal which the Automatic Machine & Screw Co. of America has been trying to consummate with the Hartford, (Conn.) Machine Screw Co., is off. The latter company gave an option on its plant, which included the Western Automatic Machine Screw Co., of Elyria, O. This has expired.

The Pottstown Bridge Co., of Pottstown, Pa., capital stock $300,000, has organized by electing Myron C. Wick president, Francis H. Saylor, vice-president and general manager, and Edwin McEwen secretary and treasurer. They, with Henry G. Morse and A. W. Milton, constitute the board of directors. The works started up July 11, after an idleness of four years, on an order for 10,000 tons of structural work for the New York Ship Building Co.

Edward Brown, manufacturer of recording pyrometers, Philadelphia, has noted a marked increase in business in the past three months, in view of the unprecedented activity in the iron trade. Recent orders have been in excess of his capacity.

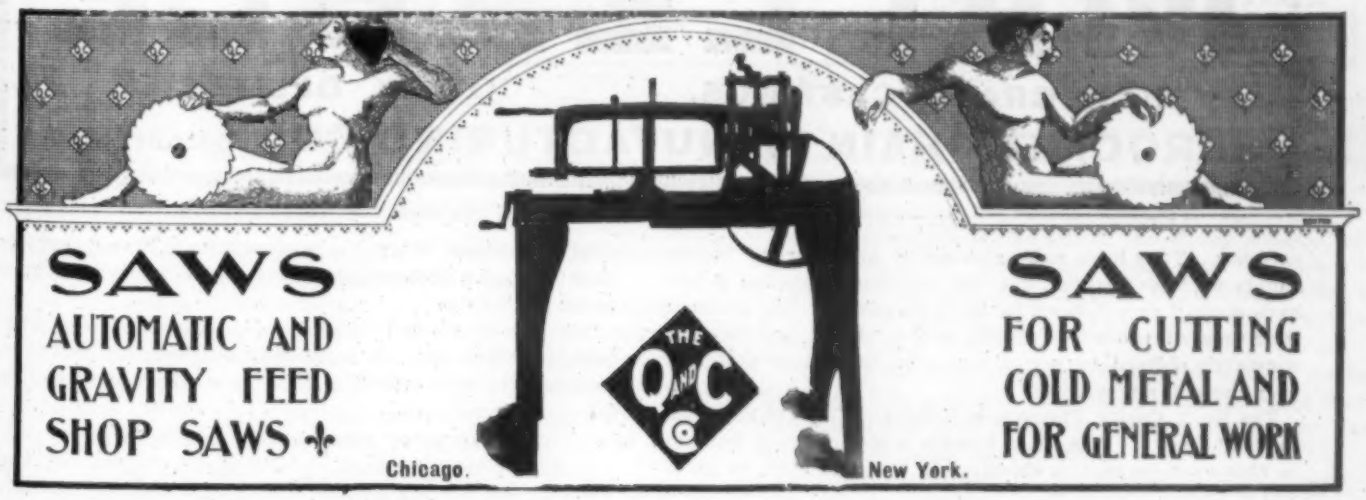
The plant, machinery, patents, etc., of the National Water Tube Boiler Co., in New Brunswick, N. J., were sold at public auction July 19, to V. M. W. Suydam, representing a New Brunswick syndicate, for $15,400. The company a few years ago became insolvent.

The spiegel furnace of the Lehigh Zinc Works, Bethlehem, Pa., is about to go in blast.

The Reading Iron Co., Reading, Pa., has purchased the Ringgold furnace from the Reading Coal & Iron Co. It has been out over 20 years.

The National Steel Co. does not expect to have its two new furnaces at Youngstown, O., completed and ready for operation until some time in the coming fall. One furnace will probably be ready to blow in about Oct. 1 and the other about Dec. 1. Work will begin shortly on a third 600-ton furnace at Youngstown, this having been decided upon recently.

The Gates Iron Works, Chicago, report that, instead of showing any slackening up on account of high prices, the number and size of orders are constantly increasing. The volume of accepted orders for the first half of this year exceeds by 33⅓ per cent that of last year and is only limited by their



MOUNT SAVAGE FIRE BRICK.

UNION MINING CO,

Proprietors of the CELEBRATED Mount Savage Fire Brick

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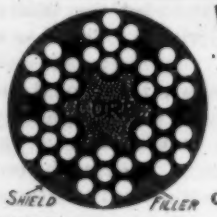

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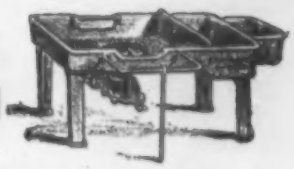

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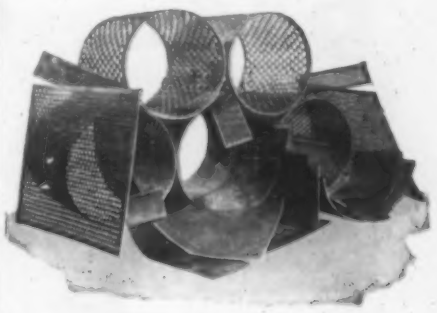

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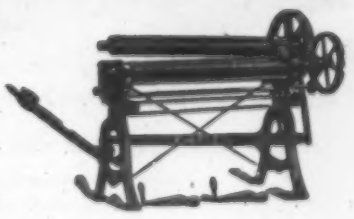

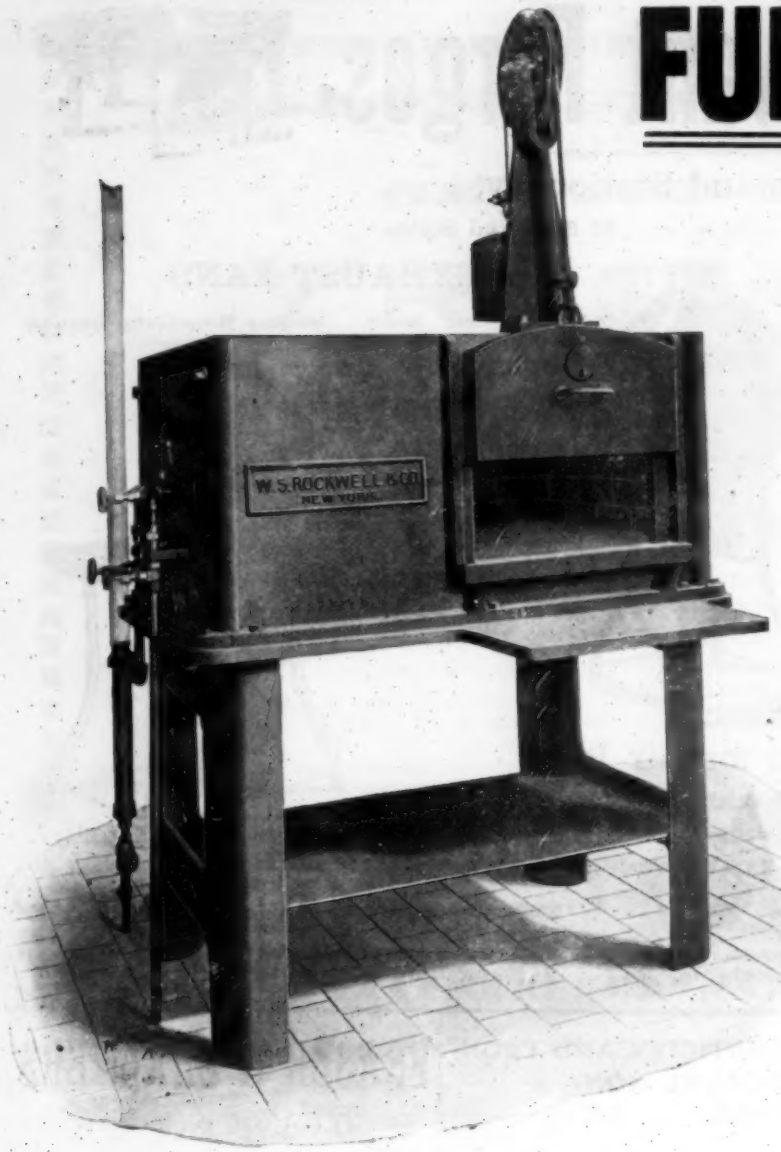

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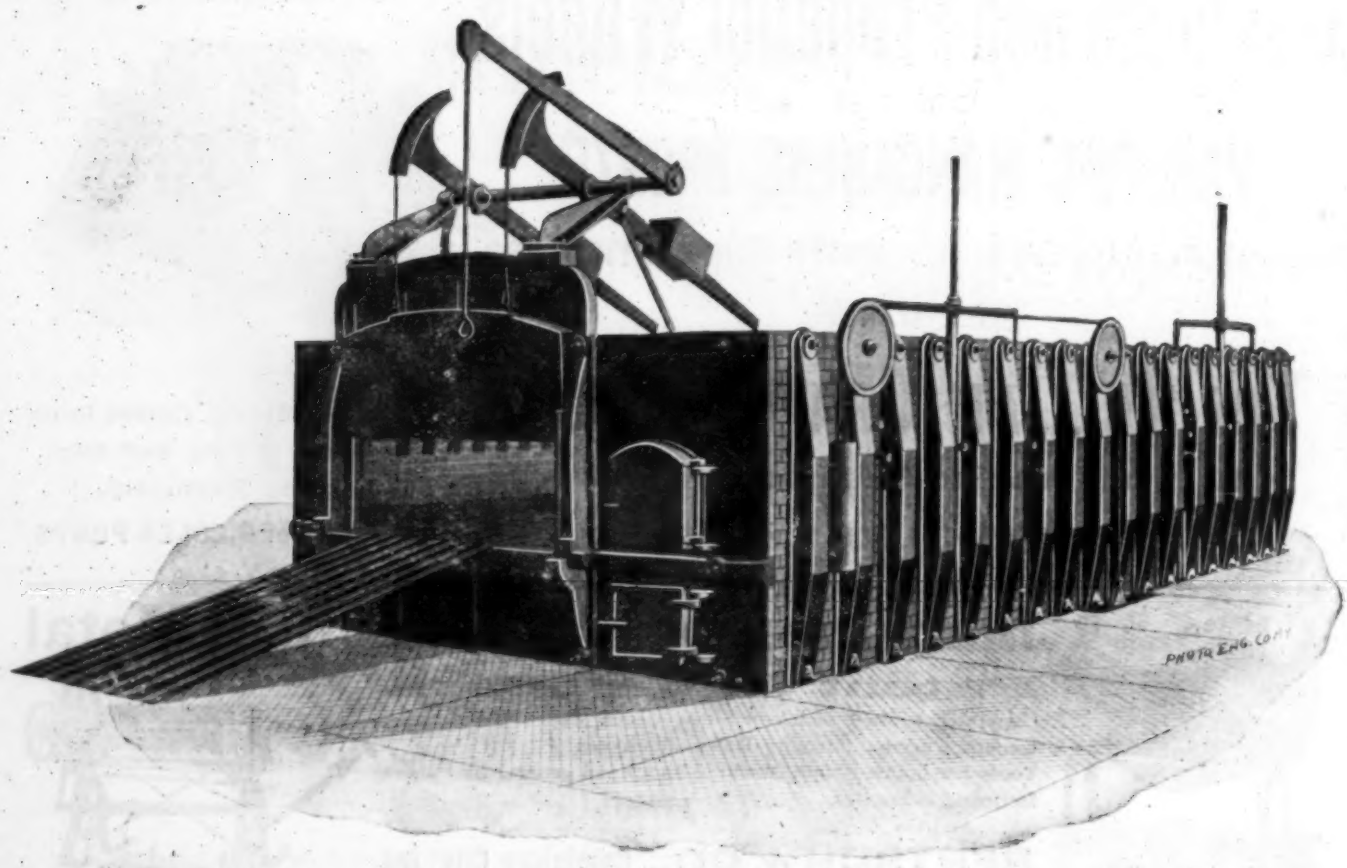

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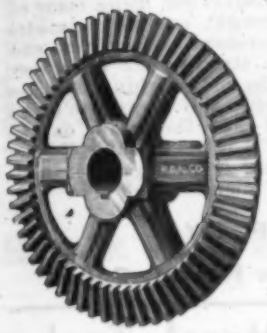

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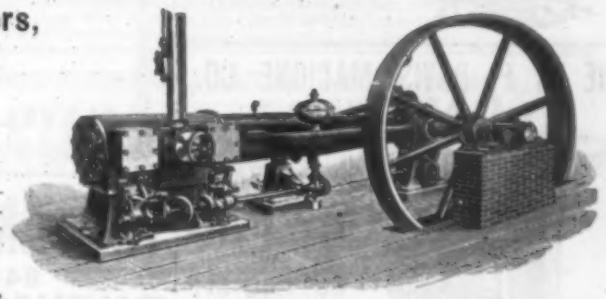

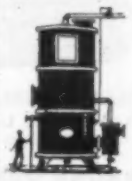

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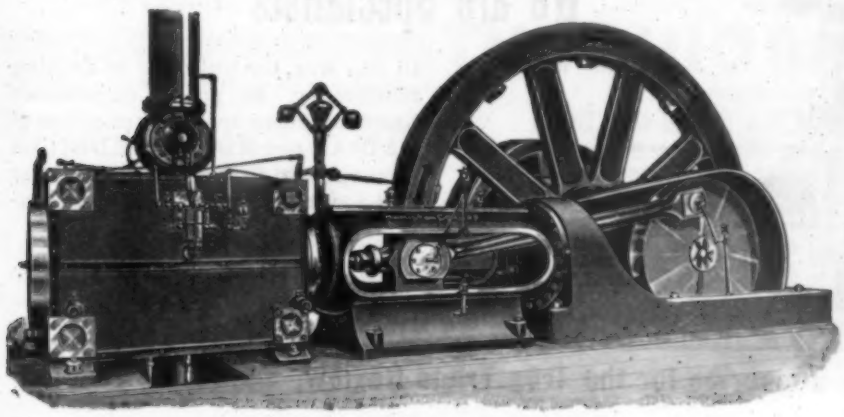

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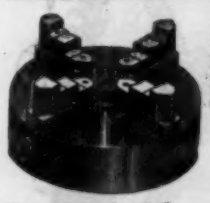

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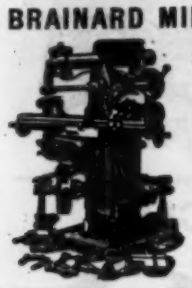

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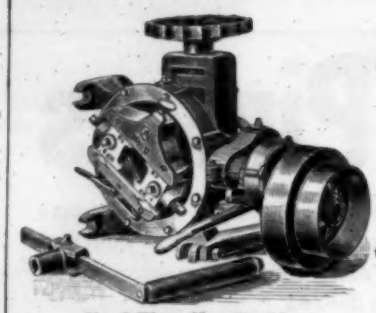

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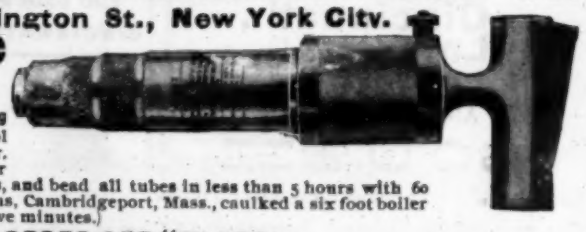

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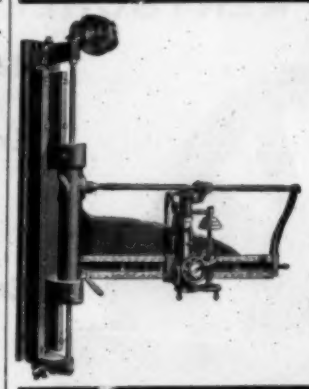

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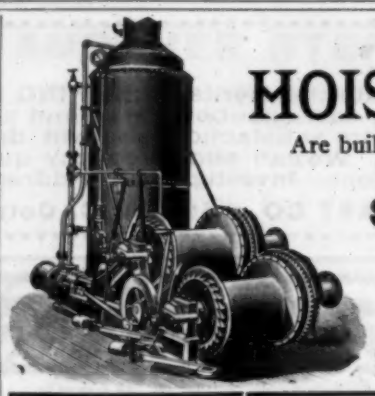

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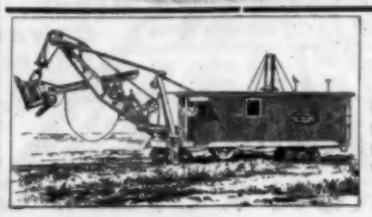

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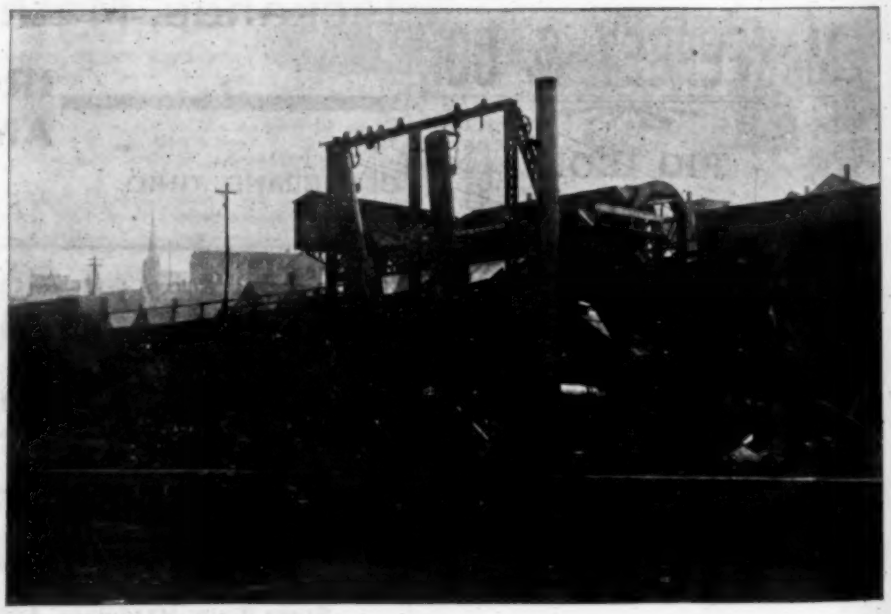

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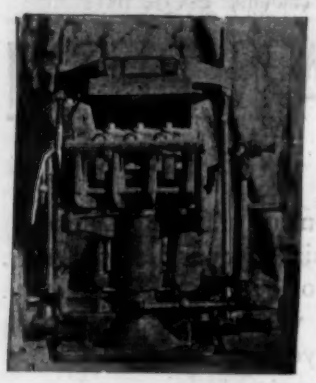

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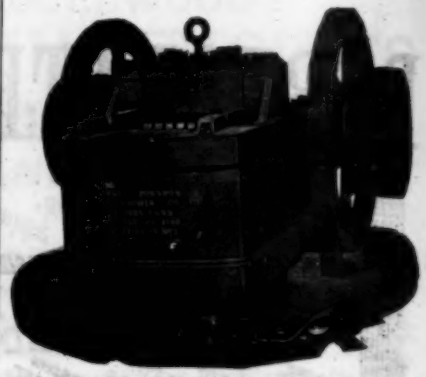

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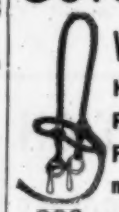

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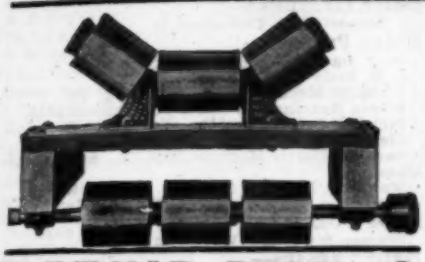

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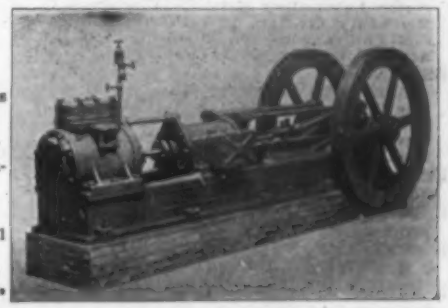

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CHUCKS—
Skinner Chuck Co., New Britain, Conn.

COAL CUTTERS—
The Ingersoll-Sergeant Drill Co., New York.
Jeffrey Mfg. Co., Columbus, O.

COAL SCREENS—
Rob't. Aitchinson Per. Metal Co., Chicago, Ill.
Harrington & King Per. Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.

COAL AND COKE—
Forster, Waterbury & Co., Chicago, Ill.
H. C. Frick Coke Co., Pittsburg, Pa.
McKeefrey & Co., Leetonia, O.
Washington Coal and Coke Co., Pittsburg, Pa.
Pickands, Mather & Co., Cleveland, O.

COAL HANDLING MACHINERY—
Robins Conveying Belt Co., New York City.

COAL MINING MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
Webster Camp & Lane Machine Co., Akron, O.

CONVEYORS—
Jeffrey Mfg. Co., Columbus, O.
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.
Robins Conveying Belt Co., New York City.

COMPAROMETERS—
Vulcan Mfg. Co., Pittsburg, Pa.

COMPRESSED AIR SHOP TOOLS—
Clayton Air Compressor Works, New York City.
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.
Q & C Co., Chicago, Ill.
American Pneumatic Tool Co., New York City.
Manning, Maxwell & Moore, New York City.

COMPRESSION COUPLINGS—
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

CONTRACTORS FOR CLEANING BOILERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

CORE OVENS—
Millett Core Oven Co., Brightwood, Mass.

CORRUGATED IRON—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.

CRANES AND DERRICKS—
Wm. Tod & Co., Youngstown, O.
Marion Steam Shovel Co., Marion, O.
Edwin Harrington, Son & Co., Philadelphia.
Reading Crane & Hoist Works, Reading, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Excelsior Iron Works Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

CRUCIBLES—
Henry L. Schwarzenberg, Cleveland, O.

CUPOLAS—
Riter-Conley Mfg. Co., Pittsburg, Pa.

DIES—
Danielson Machine & Tool Co., Cleveland, O.

DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

DRILL GRINDERS—
J. Wendell Cole, Columbus, O.

DRILL PRESSES—
W. P. Davis Machine Co., Rochester, N. Y.
C. H. Besly & Co., Chicago, Ill
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington, Son & Co., Philadelphia.
Bickford Drill & Tool Co., Cincinnati, O.
Cleveland Tool & Supply co., Cleveland, O.
Baush & Harris Machine Tool Co., Springfield Mass.
Manning, Maxwell & Moore, New York City.
Danielson Machine & Tool Co., Cleveland, O.

DROP FORGINGS—
Wyman & Gordon, Worcester, Mass.

DROP PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield Mass.

DRY KILNS—
S. F. Sturtevant Co., Boston, Mass.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELEVATORS—
The Lane & Bodley Co., Cincinnati, O.

ELEVATING AND CONVEYING MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.
Sprocket Chain Mfg. Co., Detroit, Mich.
Robins Conveying Belt Co., New York City.
Excelsior Iron Works Co., Cleveland, O.

EMERY AND CORUNDUM WHEELS—
C. H. Besley & Co., Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
Cleveland Tool & Supply Co., Cleveland, O.
W. P. Davis Machine Co., Rochester, N. Y.

EMERY WHEEL MACHINERY—
J. Wendell Cole, M. E., Columbus, O., or Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.
Cleveland Tool & Supply Co., Cleveland, O
W. P. Davis Machine Co., Rochester, N. Y.

ENGINEERS AND CONTRACTORS—
Walter Kennedy, Pittsburg, Pa.
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville Ohio.
E. E. Erickson, Pittsburg, Pa.
John T. Jones & Co., Chicago, Ill.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.

ENGINE PACKING—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

ENGINES (OIL)—
The Aultman Co., Canton, O.

ENGINES (STEAM)—
W. P. Davis Machine Co., Rochester, N. Y
Wm. Tod & Co., Youngstown, O.
S. F. Sturtevant Co., Boston, Mass.
The Edward P. Allis Co,, Milwaukee, Wis.
The Hooven, Owens & Rentschler Co., Hamilton, O.
Lane & Bodley Co., Cincinnati, O.
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.
I. & E. Greenwald Co., Cincinnati, O.
Webster Camp & Lane Machine Co., Akron, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.

Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

ENGRAVERS AND ELECTROTYPERS—
Central Electrotype & Engraving Co., Cleveland, O.
National Engraving Co., Cleveland, O.,
Samuel R. Mason, Cleveland, O.

EXHAUST HEATING APPARATUS—
B. F. Sturtevant Co., Boston, Mass.

FANS—
B. F. Sturtevant Co., Boston, Mass.

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

FILES, MAKERS OF—
C. H. Besly & Co., Chicago, Ill.

FIRE BRICK AND CLAY—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield,
Dover Fire Brick Co., Cleveland. Pa.
F. B. Stevens, Detroit, Mich.
Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
A. F. Smith & Co., New Brighton, Pa.

FIRE PROOF COVERING—
C. H. Besly & Co., Chicago, Ill.

FLEXIBLE SHAFTS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FLUE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FOUNDRIES—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
The Lane & Bodley Co., Cincinnati, O.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
I. & R. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Excelsior Iron Works Co., Cleveland, O.

FOUNDRY SUPPLIES—
Clearfield Fire Brick Co., Clearfield, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
A. F. Smith & Co., New Brighton, Pa.
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Millett Core Oven Co., Brightwood, Mass.
Cleveland Facing Mill Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.
Henry L. Schwarzenberg, Cleveland, O.
King Improved Sand Blast Co., Detroit, Mich.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.

FORGINGS—
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Bræburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Danielson Machine & Tool Co., Cleveland, O.

FRICTION METAL—
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
Henry L. Schwarzenberg, Cleveland, O.

FURNACES—
Playford Stoker Co. Cleveland, O.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md

FUEL OIL BURNERS—
W. S. Rockwell & Co., New York City

GALVANIZED IRON—
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZERS—
Ætna-Standard Iron & Steel Co., Bridgeport, O
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

GEARING—
I. & R. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
Brainard Milling Machine Co., Hyde Park, Mass.
The Van Dorn & Dutton Co., Cleveland, O.

GEAR CUTTERS—
Brainadr Milling Machine Co., Hyde Park, Mass.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GREASE—
A. F. Boettcher, Rowlands, Pa.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos. Dixon Crucible Co., Jersey City N. J.

GRATE BARS—
Geo. B. Sennett Co., Youngstown, Ohio.

GRAY IRON CASTINGS—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O
Brass Founders' Supply Co., Newark, N. J.

HACK SAWS—
Millers Falls Co., New York City.
Q & C Co., Chicago, Ill.

HANGERS—
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HOISTS—
Reading Crane & Hoist Works, Reading, Pa.
The Lane & Bodley Co., Cincinnati, O.
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

HEATING AND VENTILATING APPARATUS—
B. F. Sturtevant Co., Boston, Mass.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill
Parkhurst & Wilkinson Co., Chicago, Ill.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O

HOISTING MACHINERY—
Link-Belt Machinery Co., Chicago, Ill.
Reading Crane & Hoist Works, Reading, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati, O
Excelsior Iron Works Co., Cleveland, O.
Earl C. Bacon, New York City.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.
Robins Conveying Belt Co., New York City.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

HOTELS—
United States Hotel Co., Cleveland, O.

IMPULSE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Shiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.

IRON NAILS AND STEEL—
Bethlehem Iron Co., South Bethlehem, Pa.
C. H. Besly & Co., Chicago, Ill.
R. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport O.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.

IRON WORKING TOOLS—
H. Bickford, Lakeport, N. H
C. H. Besly & Co., Chicago, Ill.
The F. B. Shuster Co., New Haven, Conn.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Brainard Milling Machine Co., Hyde Park, Mass.
Baush & Harris Machine Tool Co., Springfield, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Ball & Screw Co., Cleveland, O.
W. P. Davis Machine Co., Rochester, N. Y.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

LUBRICATORS—
A. F. Boettcher, Rowlands, Pa.

MACHINISTS' TOOLS AND SUPPLIES—
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Baush & Harris Machine Tool Co., Springfield Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Western Mfg. Co., Springfield, O.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
The Lane & Bodley Co., Cincinnati, O.
H. A. Streeter, Chicago, Ill.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.

MANUFACTURING CHEMISTS—
We Fu Go Co., Cincinnati, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.

METAL BEARINGS—
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
Swarts Metal Refining Co., Chicago, Ills.
F. R. Phillips' Sons Co., Philadelphia, Pa.
Henry L. Schwarzenberg, Cleveland, O.

MILLING MACHINES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Brainard Milling Machine Co., Hyde Park, Mass
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, NewYrok City.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Robins Conveying Belt Co., New York City.
Excelsior Iron Works Co., Cleveland, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
W. S. Rockwell & Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.

ORE CRUSHERS—
Earl C. Bacon, New York City.
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
Harrington & King Per. Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
The Shearer-Peters Paint Co., Cincinnati, O.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland, O.
PERFORATED SHEET METAL
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
PIG IRON—
Clinton Iron & Steel Co., Pittsburg.
Forster, Waterbury & Co., Chicago, Ill.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
R. H. Stroud & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
The Brier Hill Coal & Iron Co., Youngstown, O.
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co.. Chicago, Ill.
PIPE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.
PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City
PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn.
PLANERS—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chcago, Ill.
PLUMBERS, AND GAS FITTERS, SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.
PNEUMATIC TOOLS—
American Pneumatic Tool Co., New York City
Q & C Co., Chicago. Ill.
PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.
Vulcan Mfg. Co., Pittsburg, Pa.
POWER DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield Mass.
POWER PRESSES—
Bertsch & Co., Cambridge City, Ind.
R. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati, O.
R. A. Delano, Chicago. Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.
PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
R. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
PRESSURE GAUGES—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.
PULLEYS—
W. A. Jones Foundry Co., Chicago, Ill
The Lane & Bodley Co., Cincinnati, O.
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
PUMPS (STEAM)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill,
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
PUNCHES—
R. Konigslow & Bro. Cleveland, O.
PYROMETERS—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.
RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
RIVETS—
Champion Rivet Co., Cleveland, O.
Jonse & Laughlins, Ltd., Pittsburg, Pa.
RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.
ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sargeant Drill Co., New York.
ROLLING MILL MACHINERY—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa
ROOFS—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
SAND BLAST MACHINES—
King Improved Sand Blast Co., Detroit, Mich.
SAWS—
Peter Gerlach & Co., Cleveland, O.
SCREENS FOR COAL ORE, ETC.—
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
SCREWS—
C. H. Besly & Co., Chicago. Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co.. Chicago, Ill
SCREW MACHINES—
Cleveland Ball & Screw Co., Cleveland, O.
SEAMLESS TUBES—
Shelby Steel Tube Co., Cleveland, O.
SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
SHAFTING—
The Lane & Bodley Co., Cincinnati, O.
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Bethlehem Steel Co., South Bethlehem, Pa.
SHAPERS—
W. P. Davis Machine Co., Rochester, N. Y.
Baush & Harris Machine Tool Co., Springfield, Mass.
SHEARING AND PUNCHING MACHINERY—
Bertsch & Co., Cambridge City, Ind.
Danielson Machine & Tool Co., Cleveland, O.
SHEET IRON—
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
R. H. Stroud & Co., Chicago. Ill.
Republic Iron & Steel Co., Chicago, Ill.
SHIP YARDS—
Wm. Cramp & Sons, Philadelphia, Pa.
SPECIAL MACHINERY—
Edwin Harrington Son & Co., Philadelphia.
Q & C Co., Chicago, Ill.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
R. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Danielson Machine & Tool Co., Cleveland, O.
STAND PIPES—
The Wm. B. Pollock Co., Youngstown, O.
STEAM BOILER INSPECTORS—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.
STEAM PIPE AND BOILER COVERING—
C. H. Besly & Co., Chicago Ill.
STEAM PACKING—
C. H. Besly & Co., Chicago, Ill.
STEAM PUMPS—
Hall Steam Pump Co., Pittsburg, Pa.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
STEAM SEPARATORS—
James Bonar & Co., Pittsburg, Pa.
Austin Separator Co., Detroit, Mich.
Harrison Safety Boiler Works, Philadelphia, Pa.
STEAM SHOVELS AND DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
STEAM SPECIALTIES—
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James Bonar & Co., Pittsburg, Pa.
STEEL—
Otis Steel Co., Cleveland, O.
R. H. Stroud & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.
STEEL BALLS—
Cleveland Ball & Screw Co., Cleveland, O.
STEEL CASTINGS—
Otis Steel Co., Cleveland, O.
Q & C Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.
STEEL PLANTS—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.
STEEL BLOOMS AND BILLETS—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Steel Co., South Bethlehem, Pa.
Ohio Steel Co., Youngstown, Ohio.
The Lorain Steel Co., Lorain, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
STEEL STAMPS AND STENCILS—
J. H. Fleharty & Co., Cleveland, O.
STEEL TUBES—
Shelby Steel Tube Co. Cleveland, O.
STOKERS—
Playford Stoker Co., Cleveland, O.
TANKS—
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowellville, O
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
TANK CARS—
The Wm. B. Pollock Co., Youngstown, O.
TIN AND TERNE PLATES—
R. H. Stroud & Co., Chicago, Ill.
American Tin Plate Company, Chicago, Ill.
TIN PLATE MACHINERY—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
TOOL STEEL—
C. H. Besly & Co., Chicago, Ill.
Bræburn Steel Co.. Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.
TRANSMISSION MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
W. A. Jones Foundry & Machine Co., Chicago, Ill
Jeffrey Mfg. Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
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Shelby Steel Tube Co., Cleveland, O.
S. Fix' Sons, Cleveland, O.
TUBE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.
TUBE WELDING—
S. Fix Sons, Cleveland, O.
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Republic Iron & Steel Co , Chicago, Ill.
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C. H. Besly & Co., Chicago, Ill.
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Vulcan Mfg. Co., Pittsburg, Pa.
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Manning, Maxwell & Moore, New York City.
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The Ironsides Company, Columbus, O.
WIRE FILLER—
The Ironsides Company, Columbus, O.
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The F. B. Shuster Co., New Haven, Conn.
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Cleveland Rolling Mill Co., Cleveland, O.
WIRE ROPE COATING—
The Ironsides Company, Columbus, O.
WIRE ROPE FILLING—
The Ironsides Company, Columbus, O.
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BRÆBURN STEEL COMPANY, Bræburn, Pa.

MANUFACTURERS OF

FINE TOOL STEEL AND FORGINGS. ALSO SPRING HAMMER, AND MACHINERY STEEL OF HIGH QUALITY. FINE OPEN-HEARTH STEEL.

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MORE WEAR from your tools

.....Almost no **STEEL EXPENSE**

NO TROUBLE

"It pays to use the most reliable tool steel in the market."

SANDERSON BROS. STEEL CO.

Cleveland Warehouse, 97 Water St.

CRESCENT STEEL

ESTABLISHED 1863 * INCORPORATED 1888.

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La BELLE STEEL CO., Pittsburgh, Pa.

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CRUCIBLE CAST TOOL STEEL.

SPECIAL GRADES FOR ALL PURPOSES.

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COLD ROLLED STRIP STEEL
FLAT & COILED FOR STAMPING BLANKING DRAWING, SPRINGS ETC
PITTSBURG, PA.
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Don't Waste Money in Your Pattern Shop.

THE GOBEILLE PATTERN CO., Cleveland.

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Cleveland Union Station.

Pennsylvania Lines.

Foot of Bank Street.

TICKET OFFICES at Station, Euclid Av., Woodland Av., and Weddell House corner.

THROUGH TRAINS RUN AS FOLLOWS BY CENTRAL TIME

*Daily. †Daily except Sunday.

xDaily except Saturday. ‡Saturdays only.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	† 7:00 am	†12:10 pm
Salem and Pittsburg	* 8:00 am	* 8:30 pm
Pittsburgh, Bellaire and East	† 3:15 pm	† 6:25 pm
Philadelphia and New York	* 2:10 pm	*11:30 am
Baltimore and Washington	* 2:10 pm	*11:30 am
Alliance and Pittsburgh	* 2:10 pm	*11:30 am
Ravenna and Alliance	* 5:00 pm	* 8:45 am
Philadelphia and New York	*11:10 pm	* 4:30 am
Baltimore and Washington	*11:10 pm	* 4:30 am
Alliance and Pittsburgh	*11:10 pm	* 4:30 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Columbus and Cincinnati	* 8:35 am	* 5:40 pm
Indianapolis and St. L.	* 8:35 am	* 5:40 pm
Millersburg and Akron	† 3:15 pm	†12:10 pm
Col., Cin., Ind. & St. L.	x7:40 pm	*7:30 am

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We are particularly adept in mechanical wood engraving. Also make a specialty of fine half-tone photo engraving. Should be pleased to mail examples of our work on request.

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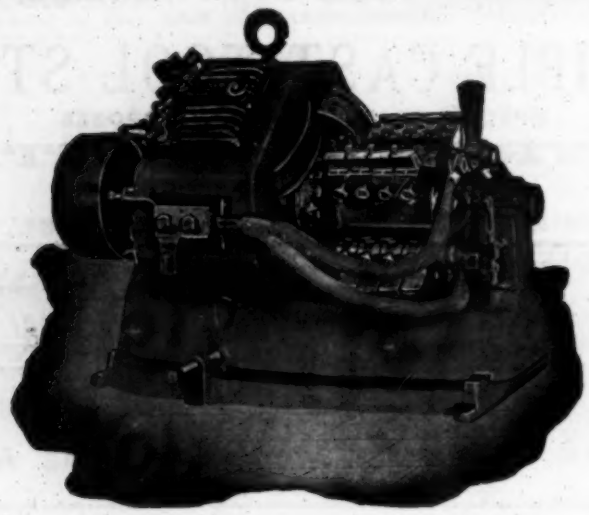
Best Babbitt for Great Weight and Speed. Best all-around Anti-friction Metal.

MERCHANT & CO., Inc. Philadelphia, New York. Chicago.

Eddy Dynamo Electro-Plating Machines

— FOR —

BICYCLE PLATING PLANTS.



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EXCLUSIVE WESTERN SELLING AGENTS.

THE PACE THAT KILLS.

The pace that kills ordinary belting, or rather unfits it for service after a year or so of hard usage—such a pace the LEVIATHAN accomplishes year after year with but slight inroads upon its strength and vitality.

LEVIATHAN BELTING

will work anywhere without damage to its texture—in underground dampness, in the heat of the forge room, or the dirt-laden air of the Clay Manufactory.

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55 57 Market Street CHICAGO.
120 Pearl Street, BOSTON

RAWHIDE BELTING

And Lace Leather.

— ALSO —

Rawhide Rope, Pinions, Picker Leather, Halters, Bell and Register Cord, and other Rawhide Goods of all kinds.

THE MABBS HYDRAULIC RAWHIDE PACKING.

CHICAGO RAWHIDE MFG. CO., 75-77 Ohio St., CHICAGO, ILL.

Advertisers who "keep everlastingly at it" win success.
That is the testimony of the shrewdest and livest of them.

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie Docks.]

Special low-phosphorous hard ore, Bessemer	$4.50
No. 1 Specular, Bessemer	$3.50@ 4.25
No. 1 Bessemer, hematite	3.00@ 4.05
Hematites No. 1 non-Bessemer	2.25@ 2.70
No. 1 Specular, non-Bessemer	2.50@ 2.75
Mesabi Bessemer	2.50@ 2.60

PIG IRON.

Cleveland (f. o. b. cars):

Bessemer	$18.65
No 1 Strong Foundry	$17 75@ 18.75
No. 2 Strong Foundry	17.25@ 18 25
Gray Forge, red short	16.00@ 16.50
No. 1 American Scotch	17.75@ 18.75
No 2 American Scotch	17.50@ 18.50
Lake Superior Charcoal	19.00@ 20.00

OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	Gross Tons.
Old iron rails	$20.00
Old steel rails (6 ft. and over)	15.00
Old steel rails (6 ft. and under)	15.00
Old car wheels	16.00
	Net Tons.
No. 1 R. R. wrought scrap	$16.50
Mill scrap	11 50
No. 1 Machine cast scrap	13.00
Iron axles	19 00
Axle turnings	11.00
Wrought turnings (free from cast)	10.00
Cast borings	9.00
Uncut wrought iron boilers	7.00
Steel boiler plates	11.00
Grate bars	8.00
Pipes and flues (clean)	10.00
Tank Iron	12,00
Hoop and band iron	9.00
Sheet iron	8.00
Wrought drillings	10.00
Malleable iron	10.50

STRUCTURAL MATERIAL.

Beams and channels (f. o. b. Cleveland)	1.85c
Angles	1.85@ 1.95c
Tees	1.90c
Universal plates	2.25@ 2.50c
Sheared plates	2 40c

MERCHANT IRON & STEEL.

[Less than car-lots, Cleveland.]

Rounds and Squares—Bar Iron.

1 to 1⅞	1.85 Base.
2 to 2⅞	.20 extra.
3 to 3½	.50 "
3⅝ to 4	.80 "
4⅛ to 4½	1.00 "
4⅝ to 5	1.30 "
5⅛ to 6	1.80 "
6⅛ to 6½	2.20 "
6⅞ to 7⅛	2.50 "
⅝ to ⅞	.10 "
⅜ to 11-16	.20 "
½ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13-32	.50 "
5-16 to 1-32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1¼ to 4 x ⅜ to 1	1.05 Base
4¼ to 6 x ⅜ to 1	.10 extra
6¼ to 8 x ⅜ to 1	.60 "
8¼ to 10 x ⅜ to 1	.80 "
1¼ to 4 x 1 1-16 to 1½	.30 "
4¼ to 6 x 1 1-16 to 1½	.40 "
6¼ to 8 x 1 1-16 to 1½	.60 "
8¼ to 10 x 1 1-16 to 1½	.90 "
2 to 4 x 1¾ to 2	.50 "
4¼ to 6 x 1¾ to 2	.60 "
6¼ to 8 x 1¾ to 2	.80 "
8¼ to 10 x 1¾ to 2	1.00 "
2 to 4 x 2⅛ to 3	.60 "
4¼ to 6 x 2⅛ to 3	.80 "
6¼ to 8 x 2⅛ to 3	1.00 "
1¼ to 1¾ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅞	.20 "
¼ to 15-16 x ⅜ to ¾	.40 "
⅜ to 11-16 x ⅜ to ¾	.50 "
½ to 9-16 x ¾ to ⅞	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1⅝ to 4 x ¼ to 5-16	.20 "
1 to 1¾ x ¼ to 5-16	.30
¾ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
½ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. **Bevel Edge Shaft Iron** 1-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No. 9 to 3-16	.90 extra
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1¼ to 4 x No. 9 to 3-16	.40 "
1¼ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
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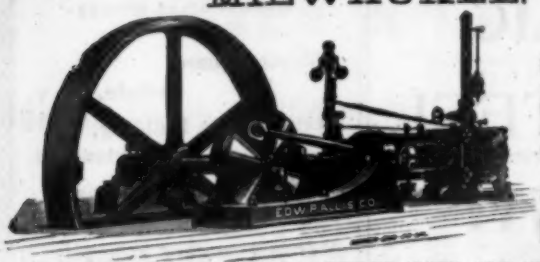
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "

THE EDWARD P. ALLIS COMPANY
MILWAUKEE, WIS.



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Blowing Engines, Hoisting Engines, Pumping Engines Air Compressors, Special Engines for Electric Lighting Street Railways and Rolling Mills, Ore Crushers, Crushing Rolls, Stamp Mills Concentrators, General Mining Milling and Smelting Machinery.

Reynolds Corliss Engines.

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Southwark Foundry & Machine Co.
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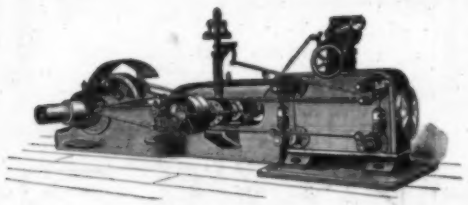
Blowing Engines, Centrifugal Pumps,
Weiss Counter-Current Condensers.

THE LANE & BODLEY CO.,
CINCINNATI, OHIO.



Engines,
ALL SIZES.

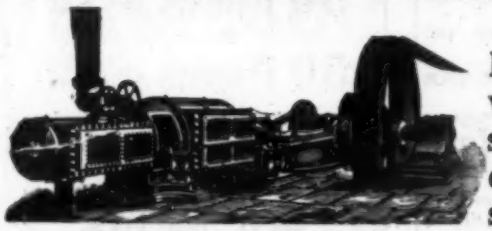
Simple and Compound.

Shafting, Hangers, Pullevs.

Belt Elevators, Saw Mills.

WILLIAM TOD & CO.
YOUNGSTOWN, OHIO.

The Porter-Hamilton Engine



Reversing Engines, Blowing Engines, Converters, Hydraulic and special heavy machinery for the iron and steel trades.

Park Building, Pittsburg.
SEWARD S. BABBITT.

The Geo. B. Sennett Co., Youngstown, Ohio

MANUFACTURERS OF

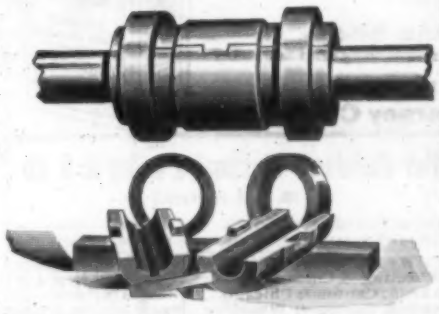
Sennett Compression Coupling

And Other Specialties.

We do not claim novelty in these Couplings so much as good material, good workmanship and extreme simplicity. We make them of a very strong cast iron, with wrought iron bands.
We make also the

SENNETT ENGINE
20 to 40 H. P.

Foundry contracts solicited for duplicate castings, from 10 lbs. to 5 tons each.



The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year $3.00.

7-16 to ½ x No. 9 to 3-16 ..... 1.50 extra
7-16 to ½ x Nos. 10, 11 and 12 ..... 1.40
⅝ x No. 9 to 3-16 ..... 1.50
⅝ x Nos. 10, 11 and 12 ..... 1.40

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in. .....
Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

⅜ to 1⅛ ..... .40 extra
½ to 13-16 ..... .50 "
⅝ to 11-16 ..... .60 "
⅝ to 9-16 ..... .80 "
⅜ to 7-16 ..... 1.10 "
½ to 9-16 x 3-16 ..... 1.00 "
⅝ to 11-16 x ¼ ..... 1.20 "

Half Oval and Half Round.

2½ to 3 ..... .60 extra
⅜ to 2 ..... .50 "
½ to 13-16 ..... .70 "
⅝ to 11-16 ..... .90 "
½ to 9-16 ..... 1.20 "
⅜ to 7-16 ..... 2.50 "
5-16 ..... 3.50 "
¼ ..... 4.50 "

Half Ovals less than ¼ their width in thickness extra price.

Horse Shoe Iron.

All sizes ..... 1 c. extra.
Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

Steel Bands.

Width In Inches.	English Standard Gauge.	
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16"	1.50 Base.
		Extras.
1¼ to 6,	" 10, 11, 12 or ¼"	.05 per 100 lbs
1 to 1¼,	" 7, 8, 9 or 3-16"	.10 "
1 to 1¼,	" 10, 11, 12 or ¼"	.15 "
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20 "
13-16 and ⅞,	" 10, 11, 12 or ¼"	.25 "
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30 "
11-16 and ¾,	" 10, 11, 12 or ¼"	.35 "
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40 "
9-16 and ⅝,	" 10, 11, 12 or ¼"	.45 "
½,	Nos. 7, 8, 9 or 3-16"	.55 "
½,	" 10, 11, 12 or ¼"	.60 "
7-16	" 7, 8, 9 or 3-16"	.75 "
7-16	" 10, 11, 12 or ¼"	.85 "
⅜,	" 7, 8, 9 or 3-16"	.95 "
⅜,	" 10, 11, 12 or ¼"	1.05

Iron and Steel Hoops.

Width Inches.	English Standard Gauge.	
7-16 to 3	Nos. 13, 14, 15 and 16	1.60 Base
		Extras.
7-16 to 2,	" 17, 18, and 19	.05 per 100 lbs
7-16 to 2,	" 20	.10 "
7-16 to 2,	" 21	.15 "
7-16 to 1¼,	" 22	.25 "
⅜ to 1¼,	" 13, 14 and 15	.05 "
½ to 1¼,	" 16, 17 and 18	.10 "
1¼ to 1¾,	" 19 and 20	.10 per 100 lbs.
1¼ to 1¾,	" 21	.20 "
1¼ to 1¾,	" 22	.30 "
15-16 and 1,	" 13, 14 and 15	.15 "
15-16 and 1,	" 16, 17 and 18	.15 "
15-16 and 1,	" 19 and 20	.20 "
15-16 and 1,	" 21	.25 "
15-16 and 1,	" 22	.35 "
⅝,	Nos. 13, 14 and 15	.20 "
⅝,	" 16, 17 and 18	.25 "
⅝,	" 19 and 20	.30 "
⅝,	" 21	.35 "
⅝,	" 22	.45 "
¾ and 13-16	Nos. 13, 14 and 15	.30 "
¾ and 13-16	" 16, 17 and 18	.35 "
¾ and 13-16	" 19 and 20	.40 "
¾ and 13-16	" 21	.45 "
¾ and 13-16	" 22	.50 "
¾ and 13-16	" 23	.60 "
11-16,	Nos. 13, 14 and 15	.35 "
11-16,	" 16, 17 and 18	.40 "
11-16,	" 19 and 20	.50 "
11-16,	" 21	.60 "
11-16,	" 22	.70 "
11-16,	" 23	.80 "
⅝,	Nos. 13, 14 and 15	.40 "
⅝,	" 16, 17 and 18	.45 "
⅝,	" 19 and 20	.55 "
⅝,	" 21	.65 "
⅝,	" 22	.75 "
⅝,	" 23	.85 "
9-16,	" 13, 14 and 15	.45 "
9-16,	" 16, 17 and 18	.50 "
9-16,	" 19 and 20	.60 "
9-16,	" 21	.70 "
9-16,	" 22	.80 "
9-16,	" 23	.90 "
⅝,	" 13, 14 and 15	.55 "
⅝,	" 16, 17 and 18	.60 "
⅝,	" 19 and 20	.70 "
⅝,	" 21	.80 "
⅝,	" 22	.90 "
⅝,	" 23	1.00 "
7-16,	" 13, 14 and 15	.80 "
7-16,	" 16, 17 and 18	.90 "
7-16,	" 19 and 20	1.00 "
⅝,	" 13, 14 and 15	1.00 "
⅝,	" 16, 17 and 18	1.10 "
⅝,	" 19 and 20	1.20 "

Sheet Iron.

No. 10 ..... 2 35
No. 12 ..... 2 35
No. 14 ..... 2 45
No. 15-17 ..... 2 50
No. 18 ..... 2 65
No. 20 ..... 2 80
No. 22-24 ..... 2 80
No. 25-26 ..... 3 00
No. 27 ..... 3 20

Steel Boiler Plates—1-4 in. and Heavier.

Tank 2 50
Shell 2 60
Flange 2 75

Manufacturers of
BAR IRON,
BAR STEEL,
PLATES,
PIG IRON,
SHEETS (Black & Galvanized)
BOLTS and NUTS,
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SPIKES, ANGLES,
CUT NAILS,
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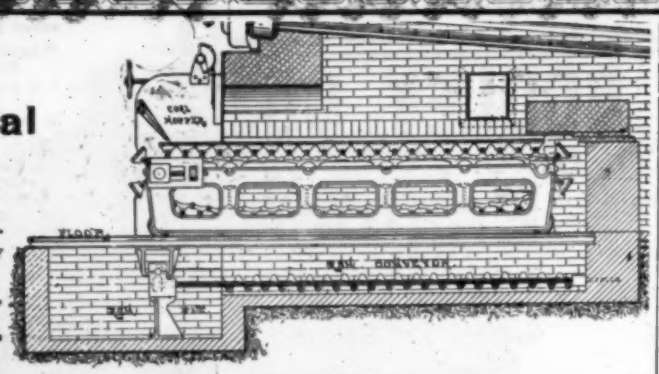
The Playford Mechanical Stoker



Guaranteed to
Abolish smoke, to increase boiler capacity and to save fuel.
For information, address,
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Marine Flange.....3 00
Fire Box.....3¼
Above includes plates 90 inches wide.
90 to 96 in. wide.....1c. lb. extra
96 to 100 in. wide.....1½c. "
100 to 104 in. wide.....2c. "
104 to 106 in. wide.....special

Wrought Pipe and Boiler Tubes.

Merchant pipe, from store.....dis. 50 and		10
Boiler tubes, 1¼ to 1½ inch...	Discount	35
" " 1¾ to 2½ inch, iron,	"	45
" " " " steel,	"	50
" " 2¾ to 4 inch, iron,	"	50
" " " " steel,	"	52½
Casing, screw and socket joint	"	45
Casing, inserted joint	"	35

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And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

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USED BY NEARLY ALL THE RAILROADS.

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3. Contain JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
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5. Every Valve Tested before leaving the factory. (2)
6. ALL GENUINE stamped with Trade Mark,

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Akron, Canton & Wheeling...	*10:20 A M	*3:30 P M
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LOW RATES to Picturesque Mackinac and Return, including Meals and Berths. Approximate Cost from Cleveland, $17; from Toledo, $14; from Detroit, $13.50.

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Cleveland, Put-in-Bay and Toledo.

Day and Night Service between

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Detroit and Cleveland Navigation Company

Cleveland, Lorain & Wheeling, Railroad Company.

Time Table effective May 15th, 1898.

Cleveland Depot: Foot of South Water Street.
Elyria Depot: Huron St., West Side.

South Bound.			Central Standard. Lorain Branch	North Bound.		
15	13	11		12	14	16
P.M.	P.M.	A.M.	LV. AR.	A.M.	A.M.	P.M.
4:25	2:25	6:27	Lorain	9:15	11:35	7:30
4:49	2:50	6:44	Elyria	9:00	11:21	7:16
4:56	2:55	7:04	Grafton	8:43	11:07	6:58
5:15	3:12	7:23	Lester	8:25	10:50	6:40
5	3	1	Main Line	2	4	6
5:30	2:25	7:20	Cleveland	8:30	11:50	7:15
5:47	2:41	7:36	Brooklyn	8:14	11:34	7:01
6:42	3:26	8:22	Lester	7:29	10:49	6:19
6:52	3:35	8:30	Medina	7:16	10:37	6:07
7:05	3:46	8:41	Chippewa La	7:04	10:26	5:55
7:20	4:01	8:56	Sterling	6:48	10:12	5:40
8:09	4:46	9:45	Massillon	6:00	9:23	4:54
8:55	5:31	10:34	Canal Dover	5:11	8:36	4:10
9:02	5:38	10:41	New Philade	5:04	8:28	4:03
9:20	6:05	11:25	Uhrichsville	4:45	8:10	3:45
.....	8:10	1:30	Bridgeport	.....	6:05	1:40
.....	8:25	.....	Bellaire	.....	5:50	.....
P.M.	P.M.	P.M.	AR. LV.	A.M.	A.M.	P.M.

No. 9 leaves Lorain 9:50 a.m., Elyria 10:05, Grafton 10:21; arrives Lester Junction 10:40. No. 10 leaves Lester Junction 3:25 p.m., Grafton 3:42, Elyria 3:57; arrive Lorain at 4:10 p.m.

Trains 1, 2, 5 and 6 daily between Cleveland and Urichsville. All other trains daily except Sundays. Electric cars between Bridgeport and Wheeling, and Bridgeport and Martins Ferry and Bellaire. Consult agents for general information as to the best routes and passenger rates to all points. M. G. CARREL, G. P. A.,

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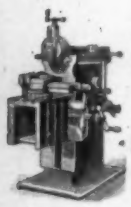

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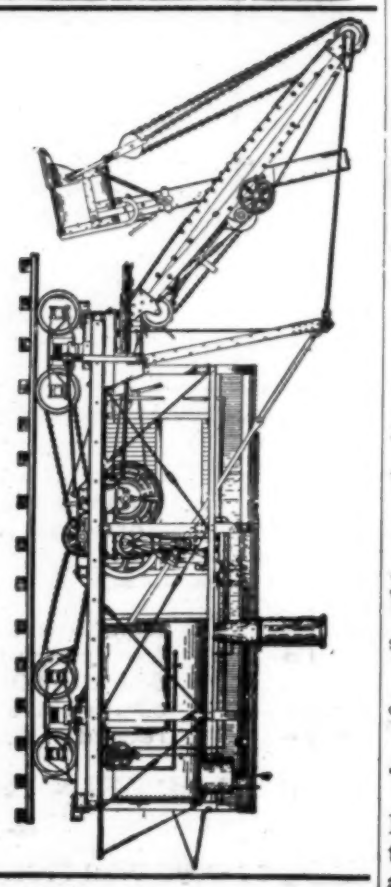

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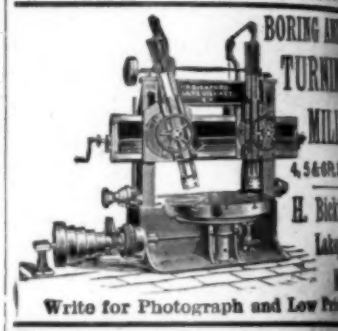

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